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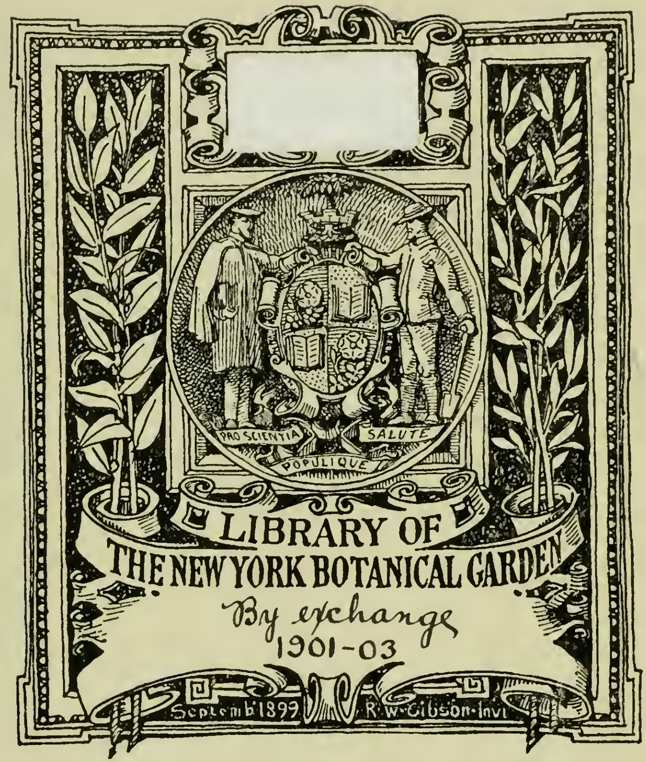
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Bulletin No. 3 Biological Series No. 1

Summer Birds of Flathead Lake

—BY—

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P. M. SILLOWAY,

PRINCIPAL, FERGUS COUNTY HIGH SCHOOL, AUTHOR OF
SOME COMMON BIRDS.

PREPARED AT THE UNIVERSITY OF MONTANA BIOLOGICAL
STATION, UNDER DIRECTION OF

MORTON J. ELROD.

UNIVERSITY OF MONTANA
1901 Missoula, Mont

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Summer Birds of Flathead Lake

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P. M. SILLOWAY

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Summer Birds of Flathead Lake

P. M. SILLOWAY.

Notes based upon observations made between June 14 and August 30, 1900. From June 14 to July 6, observations were made from the University of Montana Biological Station at the head of Flathead Lake as a center; from July 9 to July 18, at Sin-yale-a-min Lake, Mission Mountains; from July 19 to July 27, at McDonald Lake, Mission Mountains; from July 28 to August 3, in the region between the foot of Mt. McDonald and the foot of Flathead Lake; during the remainder of the period stated, the Biological Station was again the center of operations.

Additional observations were made in June and July, 1901, which have been recorded in the appropriate places.

Prepared under direction of the University of Montana Biological Station.

SIN-YALE-A-MIN LAKE.

Sin-yale-a-min Lake lies in a depression of the Mission Mountains at an elevation of 3900 feet. The depression is probably the result of glacial action, in which the bed of the lake was scooped out by the moving ice-mass, the trend being nearly from east to west. The western end of the depression is blocked by what seems to be a terminal moraine, through which the outlet of the lake makes its way. The lake is fed by a stream which comes dashing down a gorge on the northeast, the descent being so steep about a quarter of a mile from the lake that there is a succession of beautiful falls extending over several hundred feet. Between the lake and the falls the stream is thickly bordered by massive arbor vitae, whose numerous standing trunks and accompanying fallen growth form an almost impassable jungle. However, a trail can be followed from the lake to the falls with no great difficulty. Along this stream the cheerful chant of the winter wren can be heard, and in the leaping spray of the falls the American dipper loves to play.

North of the lake, rising quite abruptly from the water's edge, lies the first of a series of ridges which culminate in Sin-yale-a-min Mountain, whose bald head and snow-clad shoulders can be seen very clearly from the outlet of the lake. Between the lake and the summit of Sin-yale-a-min Peak, whose altitude is approximately 9200 feet, there rises nearly three miles of wooded mountain-side, the home of Clarke's nutcracker and Richardson's grouse, with other birds of Alpine habitat. As on the north, the southern shore of the lake is the foot of a high, wooded ridge, where the Rocky Mountain jay and black-headed jay flit among the trees, and the ruffed grouse hides in the fir thickets.

Following an easy trail leading somewhat southeast from the lake, the collector passes through a wide ravine for about a mile, and reaches a small lake or pond a few acres in extent, surrounded by a woodland free from undergrowth. Here tall handsome yellow pines (pinus ponderosa) abound, in whose tops are seen occasional flocks of chirping crossbills, lisping cedar waxwings, and other inhabitants of the woods.

West of the lake there lies an extensive region of lower primeval woodland alternating with bushy hillside, through which the outlet of the lake dashes on its course to the prairie region of the Flathead Indian Reservation, all forming an ideal collecting ground, certain to repay the careful attention of the ornithologist.

McDONALD LAKE.

McDonald Lake is at somewhat lower elevation than Sin-yale-a-min Lake, being about 3,300 feet altitude. In area it is not nearly so large, as its length measures only rather more than half that of Sin-yale-a-min, and its width about the same ratio in measurement. In our estimates we placed the length of Sin-yale-a-min at 7,000 feet, and its width at 2,200 feet. Neither is McDonald Lake as deep as Sin-yale-a-min Lake, the general depth of the former being about 70 feet while the deepest place in the latter is 250 feet.

McDonald Lake is evidently the bed of an ancient glacier, whose resistless action can be traced by fine chisellings on the sides of the jutting rocks along the lake shore. The lake is fed by a small stream which hurries down between Mt. McDonald and an adjacent mountain. Along its eastern shore the lake is overhung by a rugged, picturesque cliff, rising sheer two thousand feet or more, from whose crevices leap several miniature waterfalls like threads of spray. Along this impending cliff hawks and ravens rear their young on shelving crags, and the towering walls give back their harsh cries.

From the southern shore of the lake Mt. McDonald rises abruptly, stretching southward in craggy outline and snow-clad sides until it towers majestically into the clouds, the monarch of the Mission range.

Owing to the precipitous margins of McDonald Lake, collecting was attended with unusual difficulty and hardship. A specimen only a thousand feet away up the mountain side could be secured only by most arduous climbing, and even then was likely to take its departure to a more inaccessible station higher up the slope before the collector was within gunshot. Unidentified Raptores circled near the top of the cliff in perfect disregard of futile efforts to secure them. Once a Townsend's solitaire was shot, and it fell five hundred feet down the cliff, entailing a half hour's work to recover it and regain the lost ground. However, to the northward of the lake we found more accessible ground, in the heavy woods through which the outlet of the lake threaded its way, and forty-seven species was the result of our notes at this station.

FROM MT. McDONALD TO FLATHEAD LAKE.

From Lake McDonald, imprisoned at the base of Mt. McDonald by a small moraine, the descent to the general level of the Reservation is rapid and easy, the difference being more than a thousand feet. Within a mile of the lake the variation in the avifauna is noticeable.

Between the base of the mountains and Flathead Lake, there is a treeless valley, except such dwarf and water-loving trees as are found along most of the Montana water-courses. Scattered here and there over the plain, sometimes no farther than a hundred yards apart, again separated by a mile or more, are curious formations, depressions containing pools of stagnant water, often fringed by a growth of flags or coarse grass. Most of these depressions become dry as the season advances, though the larger ones retain a supply of water until the fall or winter storms fill them and change the neighborhood into spreading marsh. These pools attract the resident and migrant shore and water birds, and offer a valuable collecting ground for the ornithologist. The surrounding plain is inhabited by the regular residents of the open prairies, such as the long-billed curlew, western meadow lark, and species of similar habits.

Traversing the open prairie of the Flathead Reservation are several narrow, rapidly-coursing streams. These creeks are generally fringed by a thin growth of shrubbery, with occasional trees. At our camp on Crow Creek there were a few pines of large dimensions, in striking contrast to the dwarf willows and haw tree and other similar vegetation. Near the streams the birds occur much more numerously than upon the barren stretches at either side. There we found the catbird crooning its lullaby to its helpless younglings in the bushes; the yellow warbler and American redstart flitted among the foliage of the smaller trees; the kingfisher plied his art beside the stream; the song sparrow and the western yellow-throat frequented the low coverts along the water's edge. One of the delights of our stay at the Crow Creek camp was the wealth of avian melody which flooded our ears in the early morning hours. It is doubtful whether any other place could vie with this spot in the number of bird musicians in so limited an area.

The Biological Station of the Montana State University, which served as the center of operations, is situated near the mouth of Swan River, or Big Fork, as the stream is popularly called by neighboring residents. To the west of the Station building is the beautiful land-locked harbor, where the boats are kept. At the right of the mouth of Swan River lies an extensive low area, thickly set with tall, slender willows, sturdy aspens, stately cottonwoods, pliant birches, and trees of similar nature ,margined landward by remnants of the primeval evergreen forest. This swampy area is annually overflowed by the rising waters of the lake, and throughout the summer patches of stagnant water obstruct the passage of the adventurous collector. Among the dense willows the twilight gloom of the forest ever prevails, yet such uninviting surroundings form an ideal home for the vireos, American redstart, olive-backed and willow thrushes, yellow warbler, and other denizens of the wooded swamps. A generous portion of this region shows the effect of the rancher's axe, in the extensive growth of bushes and young evergreens that have quickly sprung up to hide the ravages of the lumberman; here are seen and heard the beautiful evening and black-headed grosbeaks, the energetic Wright's and Traill's flycatchers, the gamesome ruffed grouse, and numerous frequenters of the bush.

Up the river from the Station are bushy and wooded pastures. In the tops of the lofty pines growing there, flit merry troops of pine siskins, and animated Audubon's warblers; Louisiana tanagers flash among the foliage, and utter their charming carols; rufous and calliope hummers visit the clustering honeysuckles; Macgillivray's warblers and lazuli buntings chant among the lower shrubbery; Lewis's and other woodpeckers forage from the tree-trunks; and as the ornithologist climbs the rocky crests of the foot-hills beyond, he enters the summer home of the junco and Richardson's grouse.

Across the river from the Station, east of the mouth of the dashing current, are the Kalispell Club grounds, situated at the terminus of the Mission Mountains, and enclosed by extensive areas of the primeval forest. In these wooded regions the resounding tappings of the lordly pileated woodpeckers proclaim their presence; the milder though sturdy strokes of the three-toed woodpeckers can be heard; troops of capricious crossbills give animation to the highest foliage; the western wood pewee calls querulously from his bare perch in some lightning-slain forest monarch; here representatives of the warblers, the thrushes, the vireos, the hummingbirds, the tanagers, and indeed, of all the feathered residents of the region, find ample shelter and food, and consequently their days are spent in melody and animation.

The lake itself is worthy of separate mention, as a field for the attention of the ornithologist. Over its clear depth the American ospreys wheel and soar, ever and anon uttering their shrill whistles, and dipping into the water for their finny prey. Along its occasional sandy beaches flit the interesting sandpipers, and over its wooded shores flap the unsocial ravens. In suitable hollow tree-trunks families of golden-eyes are reared, perhaps under the shadow of the platform occupied by the osprey, a landmark for the adjacent shore. In the willows of the submerged margins noisy kingbirds rear their broods, and on projecting branches of deadened timber kingfishers sit watching for their prey.

In the vicinity of the Station there are several centers of avian activity which well repay the investigations of the bird student. Along the road leading southward from the river bridge, lies a small vale enclosing a stagnant pond called Daphnia Pond on account of the large numbers of daphnia pulex in it, among whose fringing rushes the western yellow-throat, the mountain song sparrow, the sora, red-winged blackbird, catbird, and other species find convenient retreat. To the eastward of the road and pond lie several rocky crests and ravines, well covered with bushy vegetation, harboring many excellent "finds" attractive to the oologist. Continuing along the road to the southward, the collector finds a beautiful pond encircled by unbroken forest. This sheet of water is known as Estey's Pond, and along its wooded borders the birds sing and thrive. In the darkened woodlands western horned owls pass the day in meditative silence; over the open area tree swallows ply to and fro in quest of hovering insects. Golden-shafted flickers tenant the decayed boles of the overflowed margins; indeed, on every hand are seen signs of avian activity, and the air is vibrant with wildwood melody.

It is scarcely necessary to add that the abundance of food throughout the region under consideration is a predominating factor in the presence and distribution of the recorded bird-life. The damp and decaying vegetation of the swampy area at the mouth of the river teems with such insect food as is most attractive to the warblers and vireos. The cleared and burnt patches abound with wild gooseberries, haws, elder, strawberries, raspberries, and the foods which are favorites of the chiefly frugivorous species. The lake shore and the hillsides are clad with wild honeysuckle, or snowberry, among which dart hummingbirds on whirring wings; and in the waste spots of bushy areas stand the giant hyssop and other seed-producing plants, a ready larder for the pine siskins, sparrows, and related Fringilline species. In few localities has Mother Nature provided so liberally for her wildwood children, and the region is accordingly populous both in number of species and in individuals.

Oological Notes from Flathead Lake

The following notes are based upon observations beginning June 14, 1900, and ending July 5, a period when many of the regular nesting birds of the region had concluded their nidification and family-rearing for the season; hence it will be understood that the notes are far from complete as a list of the birds breeding near the head of the extensive lake where the observations were made. Furthermore, the unusually early opening of the vernal season rendered the period mentioned correspondingly late for full records upon nidification; and it is but justice to the collector to state that in no case was any effort made to examine the tops of tall trees, with which the region under consideration abounds, and which were tenanted by many families of birds.

WESTERN ROBIN, *Merula migratoria propinqua* Ridgw.

The western robin is one of the representative breeding birds of the Flathead region. Though this species begins nidification quite early in the season, its habit of rearing more than one brood prolongs its family cares into the nesting period of many of the later breeders; consequently nests were found throughout June, containing eggs in various stages of advancement in incubation. The site is usually low, generally ranging between six and ten feet from the ground, and most frequently situated in an upright crotch. The foundation of the nest is commonly made of fine leaves or coarse grasses, upon which are constructed the mud walls characteristic of the robin and some of the other thrushes. The cavity ranges between three and four inches in diameter, and is generally less than two inches deep, being warmly bedded with soft dried grass, the upper rim of the walls being usually bare within. Four eggs, of a greenish-blue color, constitute the usual complement. Haw trees are selected most frequently for the location of the nests.

OLIVE-BACKED THRUSH, *Turdus ustulatus swainsonii* (Cab.)

In number of individuals, in the frequency of its melody, and in its adaptation to the sombre surroundings of the lake region, the olive-backed thrush is the typical breeding species of the lake shore. Belonging to a more northern habitat, it has been attracted by the evident conveniences of our Montana summer resort, and great numbers of representatives of the species rear their families in the firs and other trees of the Station neighborhood. Unlike most of the recorded breeding species, however, it was only entering the period of nidification at the time of these observations, the nests found during the first few days being either recently completed and not yet occupied, or having only the beginning of the regular complements.

The opening of the nesting season for this species seems to be quite uniform in the Flathead region, for nests examined the same day showed remarkably equal progress in development with others. Most of the nests found on June 14 and 15 contained either one or two eggs, or else gave evidence of having been just completed and not yet regularly occupied. It was not until June 17 that a nest was examined containing a full complement.

The olive-backed thrush is one of the low builders. Of twenty nests, none was over ten feet from the ground; two of the twenty were placed at the foregoing limit, two were nine feet from the ground, three at eight feet, three at seven feet, four at about six feet, and the remainder three and one-fourth feet and six feet from the ground. The average site is a trifle over six and one-half feet from the ground. Distances were carefully measured with a two-foot rule.

The favored site of nests in fir trees was against the main stem, at the base of one or more horizontal branches, and at a point about three-fourths the height of the tree. In one instance the nest was placed on a horizontal branch of a fir tree about two feet from the main stem, at a place probably measuring two-thirds the length of the branch from the trunk. The nest nearest the ground was found in a triple crotch of willow growing upright in a slender sprout. Another nest was found made in an upright crotch of an oblique portion of a dead, bent sapling bare of leaves. A syringa bush growing beside a path where anglers were frequently passing was chosen in one instance, and the nest placed in an upright crotch among nearly perpendicular stems. In another instance the chosen site was in a larger fir, about ten feet from the ground, on a horizontal branch four feet from the trunk.

The nest generally measures from three to three and one-half inches in height, and about four inches in diameter, outside measurements, though the structure is somewhat elliptical in outline. The cavity averages two and three-fourths inches by two and one-fourth inches, major and minor axes, and more than one and one-half inches in depth. It is founded on loose coarse grasses, the walls being made of dried grasses, green lichens, and fine weed-stems. The lining is generally fine grass, horsehair, and scanty amount of moss. Frequently a nest is found having fine bark as part of the wall materials, and occasional nests are noted without moss or lichen either in walls or lining.

The eggs of this thrush present noticeable variations in their markings. The ground color is a light greenish-blue, which in some eggs seems to be quite pale because of the lack of other marks. In other eggs the ground color is almost obscured by the number and size of the blotches of pale reddish brown. On some eggs the marks are mere specks; on others the markings are bold blotches of color. The distribution of the marks is very irregular, there being no uniformity in this respect.

The nest complement may be either four or three eggs. Of seventeen nests examined containing full sets, ten contained four eggs and the remainder contained three; hence it seems that in this region nests with four eggs are found more frequently among first sets than with only three.

The open habits in nidification of the olive-backed thrush are seemingly at variance with its shy, secretive disposition. In many instances the nests were quite unconcealed, being constructed in exposed crotches beside paths and roads, almost within reach of the passing traveler. Furthermore, the sitting bird will linger with her charge until the disturber has approached to less than arm's length. Having flitted from the nest, however, the bird will disappear in the shrubbery and remain hidden in silence, though sometimes she manifests her uneasiness by chirping mournfully from her covert.

Nests of this thrush were found in all the localities mentioned in the opening paragraphs of this paper. The favored localities, however, appeared to be the swampy area at the right of the mouth of Swan River, and the wooded, bushy lot across the road from the Station grounds. It is probable that extended examination of the woods around Estey's Pond, and the woods between it and the Station, would show numbers of these birds as making their habitations in the places suggested. A nest with full complement of eggs is shown in Plate III, figure 1.

WILLOW THRUSH. *Turdus fuscescens salicicola* (Ridgw.)

It appears that the willow thrush is not abundant in the Flathead region during the nesting season. One nest was taken, but diligent search in the vicinity of the site, and in favorable localities failed to reveal another nest, or even another specimen of this subspecies.

The nest was found on the morning of June 29. It was situated among the stems of a clump of willow saplings, and its exposed position indicated that there had been little or no instinct of concealment in the selection of the site. The sitting bird was startled from the nest, though not until the observer was within six feet of her. As there were then only three eggs in the nest, and the full complement was extremely desirable, the nest was left undisturbed. The female meanwhile, had flitted to adjacent shrubbery, and occasionally appeared momentarily to take a look at the movements of her disturber, quickly flitting back from sight.

Visiting the place on the next morning, June 30, I found the nest as I had left it on the preceding day, with only its three eggs. The female at this time was less disposed to show herself beyond the covert, but at length I was able to secure her for positive identification.

The nest was built upon the ground, being exposed on all sides for its full height, which was three and one-half inches in situ. It was founded on coarse grass stems, which also formed an external wall for most of its height. The main walls are constructed of strips of fibrous bark, weed-stems, and portions of delicate dried leaves. The fabric is lined with soft bark and fine grasses, all of a dark brownish color. The rim cavity is elliptical, its axes being two and three-fourths inches and two and three-eighths inches. The cavity is two inches deep. The three eggs were far advanced in incubation. One of the eggs is greenish blue, unmarked; the others have faint specks of pale brownish color, barely definable, upon the greenish blue ground.

The nest of the willow thrush was taken in the bushy region of the swampy area at the right of Swan River. The location seems ideal for this swamp-loving songster to be found commonly, and it is likely that other nests were in the field of examination, but were overlooked because of the extensive area and the limited time of the observer.

CATBIRD, *Galeoscoptes carolinensis* (Linn.)

Though not abundant, the catbird is regularly seen and heard in the Flathead region in the vicinity of the Station. Several pairs inhabited the shrubbery about Daphnia Pond along the road leading southward from Swan River bridge, as well as the bushy woods about the Kalispell Club grounds, nests being noted in both these localities. On July 2, a nest of the catbird was found on the Club grounds. It contained four fresh eggs. Owing to the extensive distribution of this songster and its well-known/ characteristics, no notes were made regarding it beyond its presence as a summer resident.

AMERICAN REDSTART, *Setophaga ruticilla* (Linn.)

The American redstart was noted in abundance as a resident of the swampy area 'at the right of the mouth of Swan River. So suitably adapted to the needs of this lively warbler is the willow bottom mentioned, that there the redstart appeared to be the most common warbler. Its ringing song might be heard throughout the long spring days, and the flash of its red and yellow might be seen as it fluttered here and there in quest of its insect fare. Wherever willow or haw thickets were found the redstart was certain to manifest its presence by its cheerful ditty or its restless movements among the vegetation in plying its vocation as a fly-catching warbler.

The first nest noted was taken on June 28. The nest complement was four eggs, far advanced in incubation. On that date, four other nests of this warbler were examined, all containing young birds recently hatched. It is likely that first sets of eggs of the redstart are deposited soon after the middle of June. However, on June 30 a nest was found containing four eggs, rosy fresh. Young birds from the nest had meanwhile been seen, and it is more than likely that these fresh eggs were second attempts at nidification. Furthermore, a nest was examined on July 3, whose complement was two eggs somewhat advanced in incubation, a fact indicative of a second laying at least.

All the nests of the American redstart examined by the writer in the Flathead region were placed in upright crotches formed by very small twigs branching from the main stem. The sites varied between eight and twenty feet from the ground, and were uniformly in the slender willows.

An illustration of a typical nest is given, Plate IV., Fig. 2. It is a neat, closely-woven structure, made principally of soft vegetable fibers, fine stems and rootlets, downy feathers, and bits of delicate leaves, thatched with fragments of gossamer. It stands two inches in height, with an external diameter of two and three-eighths inches. The cavity is one and five-eighths inches in diameter, and one and three-eighths inches deep.

The usual nest complement seems to be four eggs; however, a nest was mentioned containing only two eggs, well incubated. The eggs are quite variable in amount of markings. The ground color is white, upon which the markings of reddish brown are found in irregular specks and blotches.

MACGILLIVRAY'S WARBLER, *Geothlypis macgillivrayi* (Aud.)

Like the willow thrush, Macgillivray's warbler appeared to be less common than might be imagined from the suitable environments. Only one nest was noted; however, as this nest complement was so far advanced in incubation that only one of the eggs was saved for a specimen, it is likely that the lateness of the season precluded the finding of other nests of this elegant ground warbler. Favorable localities in the neighborhood were searched repeatedly without results as desired.

The nest mentioned was found in a grass tuft beside a trail made by anglers in passing up and down Swan River. It was noted on June 14, the day of the writer's arrival at the Station. The female flitted from the nest to adjacent shrubbery, acting quite indifferent regarding observation of her movements. As there was no means at hand of securing her, she was allowed to return to her nest for further observation. When the nest was approached later in the day, however, she slipped away among neighboring stems, and gave no opportunity of securing her. She succeeded in repeating the trick several times the next day, but was finally taken for identification.

The nest was placed in a tuft of grass growing among fallen branches and sprouts. It was about eight inches from the ground, probably having been raised by the growth of the grass after the construction of the nest, as frequently happens to nests of the yellowthroat and other birds that nestle in the grass tufts. The outer wall of the nest was made of long stems of dried grass; the inner of fine rootlets and horsehair. The cavity was two and one-fourth inches in diameter, and one and seven-eighths inches in depth. There were five eggs, far advanced in incubation. The ground color of the eggs is white with a faint creamy tinge. The markings are specks and blotches of dark brown, the heavier marks being generally arranged around the larger end. In situation and construction of nest, and in the appearance of the eggs, the home of Macgillivray's warbler is much like that of the yellowthroats, of whom the former is a congener.

Like the other ground warblers, the warbler under consideration spends most of its time among the shrubbery, and in its movements it is much shyer than the western yellowthroat. In the nuptial season, however, the male frequently takes a favorite position in the summit of one of the less lofty trees of the neighborhood, and there utters at frequent intervals a pretty though short and unvaried ditty, likely to be interrupted by the approach of any meddlesome ornithologist, as the performer then generally flits to a less prominent place of recital.

AUDUBON'S WARBLER, *Dendroica auduboni* (Towns.)

Away from the willow swamps, in the coniferous trees of the higher woods, Audubon's warbler is the most abundant representative of its family in the Flathead region. Among the firs, with pine siskins chattering in the lofty summits, Audubon's warbler flits in the middle and lower stories, chanting its joyous measures, sporting with its fellows, or attending to the cares of its family ensconced in a tuft of the fir branch. Upon our arrival at the Station, this warbler was quite noticeable in the animated life among the higher trees, and our first day's collection included several males of this beautiful species. At that early date for warbler nidification, a pair was observe diligently caring for the wants of their young in a nest in a large pine, far out toward the extremity of a long horizontal branch; and as late as July 2 a nest was found containing young birds recently hatched.

The finding of the first nest with eggs of this interesting warbler was an event which I recall with pleasure. Like many good finds of the collector, it was by the rarest fortune that this one habitation of *Dendroica auduboni* was taken, for though the swampy area was thoroughly searched, no other nest of this species rewarded our eager quest; however, another nest with young birds was found in a different locality several days later.

On June 27, while hunting for soras in a small grassy opening in the swamp, my attention was attracted by the peculiar chirping of a pair of western evening grosbeaks flying overhead. Noticing that they flew rapidly in one direction, I thought perhaps there was a nest in their line of flight, or that their objective point might be their nesting place, a desideratum far too valuable to be neglected. Entering the thick growth of slender willows enclosing the grassy slough, I had proceeded but a few steps when I espied a small grayish mass up in a crotch of one of the willow stems. Without being certain that it was a nest, I shook the stem, when a sitting bird flew downward obliquely and was rapidly making away among the bases of surrounding trees as I caught her by a fortunate shot. The prize proved to be a female of *Dendroica auduboni*, and I was not long in ascending to the nest and securing it, with its five fresh eggs. It is needless to add that I was not rewarded so happily in my quest for the nest of the grosbeaks.

The nest under consideration was eighteen feet from the ground, in a crotch of the main stem of the tree, so situated that it was quite exposed to view, there being no foliage for many feet above. In the gloom of the willow swamp, however, the nest was scarcely distinguishable to an observer on the ground. It appeared that the nest was rather accidental in location, for generally this warbler seemed to prefer the tufts on horizontal branches of the firs and pines.

The nest shown in Plate XIII., is two and one-fourth inches in height, and three inches in diameter. The cavity averages one and seven-eighths inches in diameter, and is one and three-fourths inches deep. The structure is strongly made of dried weed stems, vegetable fibres, and soft grasses, with feathers and horsehair worked into the inner portion of the wall for lining. The eggs are grayish white, with specks and blotches of blackish brown principally at the larger end.

As stated in a preceding paragraph, an extended search of the locality between the mouth of Swan River and the site of the nest, a region about a half mile in length, failed to reveal a second nest of this warbler. It seemed to the collector that every tree in the willow tract was closely scanned, but without results; hence the reason for the statement that this nesting seemed to be accidental or unusual. On July 2 a nest of Audubon's warbler was found along the lake, upon a rocky ridge which precipitously faced the water. It was in a medium-sized fir tree near the shore, and was about twenty feet from the ground, the site being five feet from the trunk, near the end of a branch. Both parent birds were industriously feeding the young birds in the nest.

YELLOW WARBLER, *Dendroica aestiva* (Gmel.)

The yellow warbler is a common summer resident in the Flathead region, though outnumbered by the American redstart in the willow swamps and by Audubon's warbler in the upland localities. The wide distribution of this warbler, and its preference for younger vegetation in selecting sites for its nest, give it more extended acquaintance than can be claimed for most of the other warblers. The predominance of the clear yellow in its attire makes this beautiful "yellow-bird" an attractive mark for the eye of the observer, and its vibrant chant causes the groves to ring with melody in the mating and nesting season; thus striking color, noticeable song, and neighborly manners add to the popularity of the so-called "wild canary", and serve to make it the best known representative of its family.

The accompanying illustration, Plate XV., is of a nest of the yellow warbler taken on June 18. It was made in an upright crotch ten feet from the ground in a clump of syringa which grew on the margin of Swan River near the end of the bridge. As can be seen in the figure, the nest materials are woven around the oblique twigs forming the site. It is a thickly felted structure, measuring two and three-fourths inches in height and in diameter, the cavity being one and seven-eighths inches in diameter and one and one-half inches deep.

The nest is made principally of fine grasses, with which are woven grayish downy materials, fibres of weed bark, and bits of gossamer, with a lining of horsehair. This nest is almost gray on its exterior surface from the amount of gossamer and bleached vegetable fibers. It contained five fresh eggs. They have a grayish white ground, variously flecked with pale brown. Generally the dots are gathered into an imperfect wreath around the larger end of the egg.

One of the handsomest nests of this warbler ever examined by the writer was noted in a haw tree near the point of land at the mouth of Swan River on the western side. This nest was lined throughout with white down of vegetable growth, giving the inner wall of the structure the appearance of the material in a lady's white slipper. As the nest contained young birds at the time it was found, it was left for further use of the owner; but when the place was re-visited about a month later, to secure the nest, it could not be found, having been destroyed while laborers were grubbing in that locality.

In this connection it will not be amiss to mention two nests of this warbler found late in the fall in another region. Both had evidently served their purpose as homes for families of young warblers; but under the soft texture of the base each of the nests had two eggs of the cowbird snugly covered. It was apparent that when the nests were finished, the cowbird had appropriated the snug cots before the owners had taken permanent possession, and had left their eggs for the care of the warblers. The warblers, however, being apparently unwilling to take upon themselves the care of the cowbird offspring, had immediately placed additional material upon the eggs of the parasite, thus defeating the aim of the cowbird, and relieving themselves of unwelcome inmates in their home. Such action of the yellow warbler, to avoid the care of the young cowbirds, is by no means uncommon.

Following the preceding paragraph, it will be in place to state that in no instance was evidence of the cowbird found in the Flathead region as one of the breeding residents. Nests of vireos, sparrows, warblers, and other species were examined, whose homes are generally imposed upon by the parasite, but no nest was found containing an egg of the cowbird. It seems unusual that such should be the case; it would be far stranger that the cowbird should be uncommon in this region in the nesting season.

WARBLING VIREO, *Vireo gilvus* (Vieill.)

The warbling vireo appeared to be one of the most abundant species in the vicinity of the Biological Station. Every locality described was enlivened by the presence and notes of this charming greenlet. On the day of our arrival at the Station, June 14, a nest of the warbling vireo was taken in the lot across the road from the laboratory grounds. This nest was eight feet from the ground, suspended in a small fork near the extremity of an oblique stem, and contained four eggs quite advanced in incubation. The female occupied the nest when it was discovered, and the male was singing in an evergreen tree above the clump containing the nest. While the nest was being disturbed, the female remained in the immediate neighborhood, uttering ditties similar to those of the male.

On the following day, June 15, a nest of this species was noted in a swampy woods at the right of Swan River. It was nine feet from the ground, situated as usual in a dependent fork, and contained three fresh eggs. As in the preceding instance, the female was attending to her home duties, while the male was singing near the nest. Indeed, the song of this vireo is generally a sure index of a nest in the immediate vicinity, during the nesting season.

East of the Swan River bridge and to the left of the road leading thence southward, there is an extensive area of low, damp woodland, which forms a very desirable home for the vireos, the olive-backed thrush, and other species. A nest of the warbling vireo was examined in these woods on June 18. It was six feet from the ground, pendent in a fork near the end of a low sprout. Four fresh eggs formed the complement, upon which one of the parent birds was sitting when disturbed by the collector.

Flanking the road and adjacent woods, a rocky ridge stripped of tall timber by fires and overgrown with maple clumps and small evergreens, invites the attention of the collector. On June 20, a nest of the warbling vireo was found there, situated nine feet from the ground in a maple clump. It contained four eggs advanced in incubation.

The woods around Estey's Pond form coverts for numbers of warbling vireos. While exploring the margins of this pond on June 22, we took a nest of the warbling vireo from a fork in bushes five and one-half feet from the ground. The branch sustaining the nest overhung a trail along the pond, so that anyone passing would likely brush against the nest with his head. This nest contained four eggs advanced in incubation.

The eastern or left bank of Swan River, from the bridge to its mouth, has a well-worn trail made by fishermen. A nest of the warbling vireo was noted on June 23 beside this path. It was six feet from the ground, in a clump of syringa, and contained three well-fledged young. This instance and the preceding one illustrate a common tendency of several familiar species to establish their homes along paths and trails in general use, a trait mentioned in our notes concerning the nidification of the olive-backed thrush.

The woods across the road from the laboratory grounds furnished us another note for June 26. A nest of the warbling vireo was found suspended as usual in a fork in a small clump of maple, eight feet from the ground. This nest contained four eggs, in which incubation had begun.

From the date last given until the end of our observations on July 5, nests of this vireo were examined each day, but at this period of the nesting season no more nests were found containing eggs. The foregoing notes will suffice to show the general location of the nest-site and the usual nest complement.

Plate XII. shows an illustration of a typical nest of this species.

The nest figured in the illustration is an unusually handsome structure, having its exterior covered loosely with fragments of gossamer and bits of soft birch bark, besides showing the shreds of wasp paper woven into the outer wall. The walls are made of fine grass fibers resembling delicate pine shavings. An examination of the illustration will show the manner in which the nest is suspended by its brim. The cavity is two and one-fourth inches and two inches major and minor axes of the brim, the walls curving outward below the rim to give the cavity a sub-spherical form.

The form of this species found in the Flathead region is described under the subspecific name of *Vireo gilvus swainsonii.*

RED-EYED VIREO, *Vireo olivaceus* (Linn.)

This persistent songster is fully as abundant in the Flathead region as I have found it anywhere in its Mississippi Valley range. Everywhere throughout the wooded localities, either in the low willow areas or in the heavily timbered uplands, the song of this tireless musician can be heard in the nesting season. Frequenting the treetops with other avian neighbors, it frequently falls a victim when the collector is hoping to obtain a more valuable specimen. In general, it haunts a somewhat higher level of the woods than does the warbling vireo, as its nesting sites average farther from the ground; and it does not manifest the same degree of confidence in human associations as is noticeable in the manners of its congener last described. On the day of our arrival at the Station, the red-eyed vireo was one of the commonest and noisiest (noticeable in song) birds of the woods, heard everywhere at all times during the day. Owing to the fact that this vireo generally chooses a higher site for its nest than the warbling vireo, not so many notes were made regarding its nidification.

On June 16, an apparently abandoned nest of the red-eyed vireo was found in the swampy woods at the right of the mouth of Swan River. It was pendent in a fork of an oblique willow stem, twelve feet from the ground, and contained four fresh eggs, one of which was partially destroyed, as it had a large hole pecked or gnawed in its side. The damage may have been done by a squirrel or chipmunk, the latter being a very active agent in the destruction of eggs of native birds.

On the afternoon of the same day, June 16, a nest of the red-eyed vireo was taken in the low thicket immediately west of the laboratory. This nest was nine feet from the ground, in a drooping fork of a haw tree. The complement was five fresh eggs. Like the structure of the warbling vireo described in the preceding notes, this product of the red-eyed vireo is finished exteriorly with bits of gossamer, birch bark, and flakes of wasp paper. It is attached less securely to the fork, and the walls are somewhat thinner. The materials are much the same, though those used by the red-eyed vireo are darker and less attractive. In interior measurements the nests are about the same size. The eggs of these vireos are quite similar, having a clear white ground, with specks of blackish brown irregularly and sparsely scattered over the surface, frequently more numerous at the larger end. The eggs of the red-eyed vireo average slightly larger than those of the warbling vireo.

In Plate XI, a nest with a full complement of eggs is shown. Compare with Plate XII.

CEDAR WAXWING, *Ampelis cedrorum* (Vieill.)

The cedar waxwing is probably abundant everywhere throughout Montana. In the Flathead region it was found commonly in all localities mentioned in these notes. In the vicinity of the Station it finds adequate supplies of food in the haws and elder berries in season. As a flycatcher, the cedar waxwing is as expert as the kingbird and pewees, for from a station in the top of some denuded tree, it will sally forth for long distances, take its prey with expert skill, turn in air, and return to its post in true flycatcher-like manner. Except in the nesting season, the cedar waxwing manifests its social disposition by flocking with others of its kind, resembling the crossbill in its restless movements from one treetop to another.

My first nest of the cedar waxwing was found on a trip to the Cedar Islands, at the head of McGovern's Bay, which forms the upper end of Flathead Lake. The nest was in a cedar tree, near the extremity of a horizontal branch at the top of the tree. The site was eighteen feet from the ground, but about nine feet above a rocky ledge under the tree. The structure was made entirely of the long dark green lichen or moss which droops so plentifully from tamaracks and other evergreen trees. The mossy material was pinned together with needles from the pine tree. This nest contained five eggs, in which incubation had begun, June 24.

On July 1 a nest of this species was found in the lot across the road from the laboratory. It was made in the top of a low fir tree, the situation being similar to that usually selected by the olive-backed thrush. The nest was nine feet from the ground, made among twigs against the main stem of the fir. It further resembled the work of the thrush in being placed upon a foundation of coarse dried grasses and weed stems. The nest proper, however, was constructed of lichen pinned together with needles, as described in the note upon the foregoing nest. The nest cavity was two and one-half by three inches, major and minor axes, and two inches deep. The complement was five eggs, somewhat advanced in incubation. The eggs are ashy gray, marked irregularly with spots of blackish brown.

TREE SWALLOW *Tachycineta bicolor* (Vieill.)

This beautiful swallow was found nesting abundantly in all suitable regions. Estey's Pond, whose margin was fringed with dead trees containing cavities made by woodpeckers in preceding seasons, was a favorite resort for this species. East of the ridge mentioned as flanking the Helena Club grounds and the road leading southward, was a depression which contained many tall boles with holes inhabited by the tree swallow. The islands at the head of McGovern's Bay formed attractive resorts for the tree swallow, and there we found the only nest examined containing eggs. The site of the nest was a cavity in a large cedar tree, about twenty feet from the ground, but not more than half that distance from the top of a rocky ledge beside the tree. The cavity was a natural crack in the decayed trunk, about a foot deep, in which a nest of soft chicken feathers had been made. On the day of observation, June 24, there was but one egg in the nest. The egg of this swallow is pure white, closely resembling that of the downy woodpecker, or the chimney swift.

LOUISIANA TANAGER, *Piranga ludoviciana* (Wils.)

The Louisiana tanager is one of the bird beauties of the Northwest. The male, with his clear lemon-yellow attire, varied with crimson-hued head, is a striking feature of the evergreen woods. The female is not so attractively dressed, having a robe of olive instead of brighter colors. In voice, also, this species is worthy of unusual consideration. The male has a warble quite like that of the robin, though careful discrimination may note that it is uttered more hurriedly and sharply. Its usual call consists of two syllables, which may be represented by the word "truckee", accented on the last syllable.

It was my fortune to find one nest of this tanager, and that one contained young birds about three days old, on June 21. I had been in the vicinity of the nest repeatedly on previous days, but not until this occasion was my attention directed to it. The fact of having young at this time led the parent birds to disclose their secret by their anxiety, which had not been so great when I had been near the place while the nest contained eggs. The actions of other nesting birds in that particular clump of woods, however, had aided to cause me to overlook this tanager home on former occasions, for the bushes had claimed my attention to the neglect of the trees overhead.

The nest of the Louisiana tanager was in the woods across the road from the Station grounds. It was in a fir tree, twelve feet from the ground, placed near the extremity of a drooping horizontal branch. The style of architecture was similar to that of the grosbeak, rootlets being the principal material, which were woven into a loose basket; the surrounding material, however, afforded additional service in the nature of nest walls.

LAZULI BUNTING, *Passerina amoena* (Say)

The beautiful lazuli bunting is a bird of the bushes, clearings or burnt areas overgrown with shrubbery being its favorite resorts. In song and habits it is the counterpart of its eastern congener, the indigo bunting, *Passerina cyanea* (Linn.) Mounted in the top of a tall tree, it will chant at frequent intervals its monotonous song, seemingly in happy enjoyment of the sunshine.

Though the lazuli bunting is very common in the region under consideration, but one nest was found; however, no particular effort was made to find this one or another, chance leading the collector upon it while diligently searching for the nest of a less common species. It was in a growth of young tamaracks on a ridge along Swan River. The ridge had been fire-swept in a preceding season, and over the fallen trunks had grown the tamaracks and bushes. The nest was two and one-fourth feet from the ground, slightly suspended among upright stems of sprouts growing among the tamaracks. The female was flushed from the nest, and while her home was being despoiled she manifested considerable anxiety, flitting here and there with her mate and chirping apprehensively.

The nest is figured in the accompanying illustration, Plate X. It is a rounded basket-like cup made of long dried grasses and weed fibers. The lining is made of fine grasses and scanty horsehair. The cavity averages two and one-fourth inches in diameter, and is two inches deep. The complement consisted of three fresh eggs, which are pale greenish-blue in color, almost white, unspotted.

BLACK-HEADED GROSBEAK, *Habia melanocephala* (Swains)

This beautiful western congener of the rose-breasted grosbeak, *Habia ludoviciana* (Linn.), is a common summer resident of the Flathead region. Its charming song is so nearly like that of the rose-breasted grosbeak that the listener who is acquainted with the latter might imagine that the eastern species had wandered beyond its elm and maple groves of eastern localities, and had taken up its residence in our western evergreen woods. The lower trees and thickets are more congenial to the black-headed grosbeak, haw trees being usually selected for nesting sites. Like its eastern relative, it is a tireless songster in the nesting season, everywhere proclaiming its presence by its rich, mellow expressions of content.

On our first exploring trip, in the afternoon of June 14, I found a nest of the black-headed grosbeak beside the road leading up Swan River on the eastern side. The nest was in a clump of saplings, built in a crotch twelve feet from the ground, among upright stems so small that a bundle of them had to be strapped together to support the weight of the collector. When the nest was discovered, the male was attending to family duty, a trait of the grosbeaks notable with the rose-breasted species. The nest is made loosely of weedstems and rootlets, with a lining of fine grass stems, all having a brownish color. The cavity is three inches in diameter, and one and one-fourth inches deep. The nest contained four eggs far advanced in incubation. They are light olive green, marked irregularly with specks and blotches of pale brown, usually more numerous on the larger end. One egg of this set was destroyed by a gust of wind, which carried the egg off a table and landed it upon a rock in the foundation of the laboratory. The nest with the three remaining eggs is shown in the accompanying illustration, Plate VI.

On June 19, a second nest was found in the woods at the right of the mouth of Swan River. As in the preceding instance, the nest was beside a road leading out upon the point at the river's mouth, though not generally used. The site was an upright crotch thirteen feet from the ground in a haw, near the extremity of an oblique branch. In this case the male was likewise sitting upon the eggs. The nest was made like the former, of brownish stems and rootlets, lined with fine grass stems. There were four eggs, which were advanced in incubation. This nest is also figured in an accompanying illustration, Plate IX.

WESTERN CHIPPING SPARROW, *Spizella socialis arizonae* Coues.

This familiar species was everywhere abundant, and its well-known familiarity and very general distribution caused it to receive little attention beyond the note regarding its presence in the various localities visited. Whether climbing rocky crests in search of juncos or threading the bushes in quest of other species, we were certain to find the omnipresent chipping sparrow, generally with an insect morsel in its mouth to hand over to its hungry younglings crouching in the bush.

Only one nest of the western chipping sparrow was taken, the record being for June 15. It was found in a bush near the edge of the woods at the right of the mouth of Swan River. The site was three feet from the ground, near the top of the bush. There were four eggs, in which incubation was well advanced. The nest is made altogether of very fine blackish rootlets, with a substantial lining of horsehair. The cavity is an inch and three-fourths in diameter, and one and one-half inches deep. These eggs are dingy pale green, marked principally with pale rusty brown in blotches of varying size. Besides these, there are blotches of black color irregularly found as markings.

WRIGHT'S FLYCATCHER, *Empidonax wrightii* Baird.

Though common as one of the breeding birds of the Flathead region, Wright's flycatcher seems to limit its residence during the summer to a very short season, only sufficient to rear its brood. Four nests of this flycatcher were taken during the period under consideration in these notes, and in each instance the female was taken to secure perfect identification; upon our return to the Station in the first week of August and during the month following, we were unable to secure a specimen of Wright's flycatcher in any of the localities where they had been observed earlier in the season. However, this flycatcher is unusually shy under observation, generally managing to place itself behind friendly foliage, hence its presence could be easily overlooked. It is more than probable, however, that like Traill's flycatcher, common in the same localities, it takes its departure for southern climes toward the end of July, or rather disappears from its accustomed haunts about that time.

A nest of Wright's flycatcher was found on June 15 in the edge of the woods at the right of the mouth of Swan River. It was in an upright fork five feet from the ground, in a clump of maple sprouts. It contained four fresh eggs. The nest stands three inches in height and three inches in diameter. The cavity is one and seven-eighths inches in diameter, and one and one-half inches deep. The nest is constructed of grayish vegetable fibers and shreds of birch bark, with minute downy feathers woven into the inner wall for lining, together with fine grasses used sparingly. The eggs are pale creamy white.

The second nest was taken on June 18, on the ridge east of the bridge. It was ten feet from the ground, in a crotch near the top of a maple clump, and contained five eggs advanced in incubation. This nest was also made of long grayish vegetable fibers, the coarser ones being used externally. In the inner portion of the wall were woven small downy feathers, one noticeably yellow, besides cottony material which gave the lining a felted appearance similar to some nests of the yellow warbler, *Dendroica aestiva*. This nest is one and three-fourths inches average diameter and one and three-fourths inches deep, internal measurements. In outward dimensions it is the same as in the preceding instance.

The third nest was found on the eastern side of the ridge which lies east of the Swan River bridge. It was situated in a crotch four feet from the ground in a clump of maple sprouts. In construction and appearance it is similar to the two nests described. It contained three eggs, the set being evidently incomplete, as the eggs were quite fresh, though the female was sitting when the nest was discovered. The record is for June 20.

The fourth nest of this flycatcher was taken on June 25, having been found some days before but left for further examination. It was in the edge of the swampy woods at the right of Swan River, eight feet from the ground in a crotch against an oblique stem in the periphery of a clump of maple sprouts. This nest contained four eggs, in which incubation had well begun.

Thus our notes show that the average distance of these nests from the ground was somewhat less than seven feet; all were placed in upright forks or crotches in clumps of maple, generally in the periphery of the clump; all were made of grayish vegetable fibers, having downy feathers woven into the inner surface of the walls; and the complement generally consists of four or five eggs.

KINGBIRD, *Tyrannus tyrannus* (Linn.)

The kingbird is common as a summer resident in the localities mentioned in these notes. It is seen most numerously along the margins of the lake, in the willows whose bases are submerged by the back water; there it is noisy and ubiquitous, exercising its sway over its claimed domains with its usual pugnacious disposition, and rearing its broods in the low trees of the lakeshore. Several families were noted along the margin of Daphnia Pond; and because of an unusual nesting site selected by a pair of kingbirds along the shore of this pond, this note is made. The nest was made in a cavity in a dead, denuded tree, the cavity being broken open so that the nest was exposed to view on one side, and the sitting bird easily seen as she faced the entrance or front of the cavity. As she sat thus with observant eyes for passing events, the male frequently visited her with some dainty morsel for her refreshment. The cavity was about eighteen feet from the ground. The bare stem, from which the branches had been swept by fire, resembled a pole in appearance.

The kingbird in this region chooses sites much nearer the ground and more exposed in situation than it does in more eastern localities. On July 6, as we landed from the launch that had carried us to the foot of Flathead Lake, it happened that a nest of the kingbird containing young birds was in a dwarf tree near our landing-place. A crowd of Indian lads assembled to witness our landing, and some of them espied the nest with its noisy young. It is needless to state that in a few minutes the younglings had fallen victims to the heartlessness of the crowd, being pitched out upon the water and then pelted with stones as they fluttered helplessly upon the ripples.

The dwarf trees and bushes found generally along the streams of the Flathead Reservation are commonly populated by the kingbird, and most of the nests are so low that they can be examined without climbing or reaching. In notes made later in the Reservation we find a nest in a corner of a rail fence, at a point about half the height of the fence; another in a bush by a streamside not three feet from the ground; such instances are the rule and not the exception.

WESTERN NIGHTHAWK, *Chordeiles virginianus henryi* (Cass.)

The western nighthawk is very common in the Flathead region. Its wonderful aerial evolutions at dusk, and in the afternoon of cloudy days, have given it extended acquaintance, hence it is more generally known than many of our avian neighbors. Not all persons, however, who have witnessed its volatorial powers, have heard the strange sound, resembling a steamer or gong whistle, which it utters sometimes as it plunges downward in its flight. The rocky ledges near the Station afford the nighthawk suitable nesting sites, and during the day we frequently startled the drowsy birds as they sought retirement after a period of activity at dusk and in the early morning.

One nest of the western nighthawk, or rather one set of eggs, was found, and that was taken on the last day of our collecting trip at the Station, July 5. The two eggs were on a bare rock back of the store at Holt. No nest was made for them. They were quite advanced in incubation. In color they were stone gray, with spots of blackish brown.

RED-NAPED SAPSUCKER, *Sphyrapicus varius nuchalis* Baird.

Most of the woodpeckers nest early, hence little attention was given to their nesting habits; moreover, most of them nest in sites which require strenuous climbing to reach, and as this was not our purpose while making these notes, the woodpeckers were generally passed with little notice. A family of red-naped sapsuckers, however, had selected a site so obvious that this note is given to them. It was in a dead aspen in the margin of the grassy slough in the woods at the right of Swan River, mentioned in an introductory paragraph. When the birds were observed, they were feeding their young in the cavity, the entrance being a small sub-circular hole about eight feet from the level of the water, which had surrounded the foot of the tree. On June 26, when the note was made, the young appeared to be quite well-grown, judging by the buzzing clamor they raised when the parent bird stood at the entrance with food.

BLACK-BILLED CUCKOO, *Coccyzus erythrophthalmus* (Wils.)

While I am aware that the identification is questionable, I submit the following note for what it is worth. No specimens of the black-billed cuckoo were taken or seen in the region around Flathead, a fact which makes the note of even less value; however, subsequent observation may give additional light upon the question here raised regarding this species as a summer resident of the Flathead region.

On July 3 the writer picked up an egg in a path through the swamp-woods at the right of Swan River. In size and appearance, the specimen closely corresponds to the egg of the black-billed cuckoo, or the western representative of the yellow-billed cuckoo. It had evidently been dropped in the path, and was fractured somewhat on the side on which it rested, but it made a fair specimen awaiting identification.

AMERICAN OSPREY, *Pandion haliaetus carolinensis* (Gmel.)

The American osprey is the most noticeable bird of prey in the vicinity of the Station. One of the regular noises of the day was the peculiar whistle of the osprey, which has somewhat of a ventriloquial effect, as it seems to issue from a point nearby when the author is much farther from the hearer. The cry is uttered most frequently when the birds are approaching or leaving the nest, or wheeling in the neighborhood of their home.

On the bank of the river opposite to the Station, in the Helena Club grounds, a pair of ospreys had established a home at the top of a lofty pine stub. The site had been used by ospreys in previous seasons, and was evidently a regular tenement. At our advent to the neighborhood, on June 14, the nest contained well-fledged young, which kept the elders industriously engaged in supplying the demand for fresh meat in the form of fish. We left the place on July 6, but upon our return on August 6, the nest was still used as a place of resort and as head-quarters for the parent birds in providing for the wants of the dependent youngsters. The nest is shown in Plate VIII.

SHARP-SHINNED HAWK, *Accipiter velox* (Wils.)

Owing to the retiring habits of this little Accipiter in the breeding season, few notes were made upon its occurrence near the Station. The thickets of the low swamp at the right of Swan River doubtless formed congenial resorts for this hawk, and as the same localities were abundantly populated by small birds which the sharp-shinned hawk is known to prey upon, there was little occasion for it to stir far abroad. Indeed, it is unusual for this hawk to be found far from its nesting site; if either of a pair is observed foraging regularly in a thicket in the early breeding season, a nest is likely to be found in the vicinity at the appropriate time.

A nest of the sharp-shinned hawk was taken on July 3, in the swamp woods at the right of Swan River. A most admirable site had been selected. Two large birches grew in a clump of fir trees, so that the stems of the birches and a fir formed a triangle measuring about two feet on each side. The nest was made on fir branches between the two birches, eight feet from the ground, being thus exposed to view only upon one side. It was a mass of small twigs fifteen inches in diameter, the cavity being six inches across and one and one-half inches deep. As is usually the case in the architecture of this hawk, there was nothing whatever to serve as lining. The complement was four handsomely marked eggs, well advanced in incubation.

The eggs of this set are quite variable in marking, following the rule with eggs of the sharp-shinned hawk. The general ground color is pale bluish-white. Upon this two of the eggs have their larger ends entirely covered with blotches of bright umber, the thickness of the markings giving the appearance of one large blotch. Over the remainder of their surfaces there are scattering marks of the same color. The third egg has the blotches arranged in a wreath around the smaller end, forming a likeness to a band of pale umber, with scattering marks upon the remainder of the surface. The fourth egg has the markings chiefly upon the larger end, but not so solidly as in the case of the two first described; in addition, the fourth egg has several prominent blotches of blackish brown, seemingly upon the umber markings. Of the eggs of this species, Oliver Davie says: "The eggs of the sharp-shinned hawk, Mr. Norris states, are subject to great variation in markings, and yet, as a rule, they can be identified at a glance. With the exception of the sparrow hawk, they are the smallest laid by any of the hawks found in North America, and among the most beautiful eggs of any of the Raptores. Their ground color varies from bluish-white to grayish-white, spotted, blotched, speckled, streaked and clouded with light fawn color, burnt umber, chestnut, lavendar-gray, chocolate, russet-brown and cinnamon, exhibiting an endless variety of bold and indistinct patterns of coloration and design."

SPOTTED SANDPIPER, *Actitis macularia* (Linn.)

The spotted sandpiper was found breeding in abundance along the lakeshore. Wherever there was sandy beach or gravelly shore to any extent, there the spotted sandpiper could be heard uttering its "peet weet", and could be seen "teetering" in its characteristic manner as it gleaned along the margin of the water. The long sandy stretches between the mouth of Swan River and of Flathead River were favorite resorts of the sandpipers, and there they could be heard calling at all hours of the day, and late into the evening. This shore was being gradually exposed by the falling water of the lake, and the great sandy flats were exactly suited to the tastes of the little "teeter-up".

The first nest of the spotted sandpiper was found on June 18, on the sandy point at the right of the mouth of Swan River. The female was flushed from the nest about dusk. The site was under a bare drift log, and was made in a depression three inches in diameter and one inch deep. It was made of coarse weed-stems, bits of bark and rubbish. The complement was three eggs, two placed small ends together, the third placed along the small ends of the other two. Incubation was quite advanced in these eggs. Their ground color is a polished clay, upon which are spots and blotches of dark reddish brown and blackish-brown.

My notes for June 20 record a nest of this species found on the wooded island below the Station, in Swan River, the island afterward becoming part of the mainland as the water of the river receded into its narrow channel. The nest was made in the open sand, though under trees, about ten feet from the water. It was three inches in diameter, and one and one-half inches deep, made of refuse rubbish banked around the depression in the sand. There were four fresh eggs placed small ends together and downwards, almost half buried in the loose materials of the structure.

A third set of eggs of the spotted sandpiper was taken on June 25, on the same sandy point mentioned in the former instance. The nest was in a little clump of sprouts, about twenty feet from the water, and well concealed on all sides.

It was three inches across, one and one-fourth inches deep, and was made of pieces of dried weed-stems and rubbish. There were three eggs, in which incubation had begun.

On June 27, a nest of the spotted sandpiper was found on the sandy beach at a point near the mouth of Flathead River. It was in a willow bush about twenty feet from the water, made of drift rubbish, measurements as in the preceding instance. This nest contained four fresh eggs.

A set of eggs is shown in Plate XIV.

Supplementary Notes, 1901

Fourteen nests of olive-backed thrush, *Turdus ustulatus swainsonii,* were examined in the region under consideration, in 1901. Of these, the highest site was eight feet, the lowest three and one-half feet, the average being six and one-half feet from the ground. Ten of these nests contained four eggs or young as the complement, and of the remainder, two held three fresh eggs, which might constitute incomplete sets. Nine of these nests were in upright crotches, of which eight were in maple saplings and one in a birch; the other nests were in firs, on horizontal branches beside the main stem. The first was found June 18, with fresh eggs; the last one contained eggs quite advanced in incubation, July 5.

A nest of the willow thrush, *Turdus fuscescens salicicola,* was found in the swamp-woods bordering the Jocko River at Selish, on June 16. It was made on a heap of dried and decayed leaves on fallen branches, one foot from the ground. The nest was similar in construction to that described on page 12. It contained four eggs, incubation well advanced. From the frequent notes heard, it seems that this species is more common than we supposed from our observations in the preceding season.

A nest of the American dipper, *Cinclus mexicanus,* was taken at Lake McDonald, from a shelf of rock about four feet above the water of the lake shore. It was constructed entirely of green moss, and was situated in an angle of the rock, the site giving it an ellipsoidal form. It was nine and one-half inches long, and seven and one-half inches high, with a width of seven inches from front to back. The entrance was a sub-circular hole three inches in diameter, near the middle of the front side immediately above the floor. The walls varied from one to two inches in thickness, forming a neat spherical cavity as yet unoccupied, June 24.

A nest of Wilson's warbler, *Sylvania pusilla* (Wils.), was taken on June 24, in the vicinity of McDonald Lake. It was found under the projecting shelter of a moss-covered, decayed prostrate log in a dense arbor-vitae swamp-woods. The brim was flush with the surroundings in decayed leaves, moss, and punk. The walls were made of coarse weed fibers, and the lining was a scanty layer of reddish-brown fibers and horsehair. The cavity measured two inches in diameter, and one and one-fourth inches in depth. There were four eggs, incubation quite advanced, and one egg was broken in blowing. The female was startled from her cozy home as I stepped over the log almost over the nest. In size and appearance, the eggs closely resemble those of the chickadee, having a whitish ground irregularly marked with fine specks of thin reddish-brown, the markings being thickest at the larger end.

On June 29, a nest of western yellowthroat, *Geothlypis trichas occidentallis* Brewst., was taken on a mountain-side near Flathead Lake, at an elevation of 5,000 feet. It was in the base of a low bush, eight inches from the ground. It was made entirely of coarse weed-stems, with a lining of horsehair. The cavity was one and five-eighths inches across, and one and three-eighths inches deep. There were four fresh eggs, which had a pinkish white ground, with irregular dots and blotches of thin reddish-brown. Besides this nest, several others of the year were found, one in Daphnia Pond in a tuft of rushes being made of coarse rush blades, with a scanty layer of fine stems for lining.

Macgillivray's warbler was noted more frequently than in 1900, though no nests with eggs were taken. On June 30, a nest of this warbler was found in the base of a low bush in the woods near Flathead Lake. It was eight inches from the ground, made of coarse dried grasses and lined with horsehair. The cavity was two and one-fourth inches in diameter, and one and three-fourths inches in depth. I accidentally brushed against the nest, which was filled with fledglings about ready to fly, and they fluttered out quickly into the adjacent bushes, entailing a great degree of chirping by the parents to collect the scattered younglings.

This year we were more fortunate in our search for the home of the junco. A nest of Shufeldt's junco was found on July 9, in the woods near the base of MacDougal Peak. It was on the side of a small moss-covered mound, which had been formed by the uprooting of a tree in other years. The nest was in a recess, and was made of coarse weed-stems and lined with fine light grasses. It was four inches across and two inches high after removal from the site. The cavity measured two and one-half inches in diameter, and one and one-fourth inches in depth. Its complement was four fresh eggs, which were greenish-white, marked with reddish-brown, the larger end as usual having the greater amount of markings.

While at Sin-yale-a-min Lake, a number of used nests were examined, the work of the black-headed jay, *cyanocitta stelleri annectens* (Baird). They were found in small firs, invariably along the streams, and generally about twelve feet from the ground, on horizontal branches beside the main stem. The chosen site was usually about three-fourths the height of the tree. They were made of an outer framework of coarse twigs, and were about eight inches across in exterior measurement, and five inches high. The outer wall was made of muddy moss and coarse stems, the lining being of coarse brown rootlets. The cavity averaged four and three-fourths inches in diameter, and three inches deep.

On June 28, I found a nest of the black-headed jay near a bridge over a small stream where we stopped for lunch. The nest was eighteen feet from the ground, in a stout upright fork of the main stem, which leaned over the water. It was made as described in the foregoing paragraph, having an outer framework of coarse twigs, walls of mud about a half-inch thick, an inner wall of coarse black rootlets, and a bedding of finer rootlets. There were four eggs, on which the female was sitting. She was secured for identification, and later, when the male came near, with a mouthful of grasshoppers, he was also taken. The eggs were quite advanced in incubation. They were light green in color, irregularly spotted with dark-brown. About twenty feet from the tree containing this nest was another with an old nest similar in construction, situated in a small fir as previously described. It is likely that the nest with eggs was a second nesting of this pair of jays; if such is the case, it will account for the late date of nidification, as the usual season of this jay had apparently closed in the neighborhood.

While passing through St. Ignatius, on the Reservation, our attention was attracted by the Arkansas kingbird, *Tyrannus verticallis* Say, and a nest was found in a corral, on the groove of a windlass, beside one of the uprights. It was about twelve feet from the ground, and was made of soft fibers, stems, and cordage. It contained three eggs, in which incubation had begun. The eggs of the Arkansas kingbird closely resemble those of the kingbird, being cream-white with irregular spots of reddish-brown.

Conclusion

If the foregoing were intended to be a list of the breeding birds of the Flathead region, there are many notes which might be incorporated in this report. However, it is intended simply as a record of what was done in the period mentioned; hence every note stands for a nest or specimen actually seen. On June 18, a brood of young ducks was led to the water by the parents, American golden-eye, *Glaucionetta clangula americana* Bonap., from a hole in a cottonwood near the boat-house on the Helena Club grounds. The parent birds were observed visiting and leaving the hole by younger members of our party, and upon their reporting the matter to me, we went to the place, to find that the family had taken to the water and doubtless forever abandoned their woody cell. On another occasion, when a pleasure party was spending a day near the bridge, one of the boys discovered a nest of a hummingbird, doubtless the rufous hummingbird, *Selasphorus rufus* Gmel., as it was taken from bushes overhanging the bank of Swan River. Before it was brought to my notice, the two eggs were lost and the nest destroyed. These instances are mentioned to show that no attempt has been made to prolong this list beyond the actual observation of the collector, nor was it the intention to secure a lengthy list. As a record of private collecting, it is given here in the desire to contribute to a more general distribution of the natural history data of the state.

List of Birds of the Flathead Lake Region

List of birds, with notes on their habits and distribution, observed in the Mission Mountains, the Mission Valley, and at Flathead Lake. The list comprises the birds seen from June 5 to August 29, 1900. Skins of most of the species here mentioned are deposited in the museum of the University. The numbers correspond to the A. O. U. check list.

4. AMERICAN EARED GREBE, *Colymbus nigricollis californicus* (Heerm.)

On June 20, 1901, a brood of American eared grebe was seen on Sin-yale-a-min Lake. There were nine or ten specimens in the family, and three were taken. The brood had evidently been reared on the lake, as the youngsters were incapable of extended flight, though they were in full plumage. A specimen was taken later at Mud Lake, near Flathead.

6. PIED-BILLED GREBE, *Podilymbus podiceps* (Linn.)

Not common at the northern end of Flathead Lake. One specimen noted on the eastern shore, below the mouth of Swan River.

7. LOON, *Urinator imber* (Gunn.)

Common on Flathead Lake, singly and in pairs. Also common on Swan Lake, where its clear laughing calls resound far over the little valley enclosing the lake. Not noted at McDonald Lake.

It is not likely that the Loon is more than a summer visitant to Sin-yale-a-min Lake. This sheet of water is a desirable stopping place for passing birds at nightfall. A pair of loons spent one night at the lake during our visit, and an effort was made to secure a specimen the next morning, but without success.

11. RED-THROATED LOON, *Urinator lumme* (Gunn.)

A female of this species was taken at Mud Lake, near Flathead, on July 15, 1901. It was alone, though several American mergansers were near it.

49. WESTERN GULL, *Larus occidentalis* Aud.

A common visitor at the northern end of Flathead Lake. A specimen was taken on Aug. 29, at the sand-bar near the mouth of Flathead River, associating with *Larus delawarensis* and *Sterna forsteri*.

54. RING-BILLED GULL, *Larus delawarensis* Ord.

A regular visitor to the upper end of Flathead Lake, appearing in pairs and flocks of eight to twenty, generally after boisterous days on the lake. It manifests unusual curiosity, as a boat or launch will attract it to hover about, often to its harm. Specimens were frequently taken, Aug. 23, 24, and following dates.

69. FORSTER'S TERN, *Sterna forsteri* Nutt.

Irregular visitor to the northern end of Flathead Lake. On Aug. 23, a specimen was taken near the mouth of Swan River, from a small flock that flitted capriciously over the water.

129. AMERICAN MERGANSER, *Merganser americanus* (Cass.)

On Aug. 23, a flock of six or eight mergansers appeared in the bay immediately west of the station, near the boat landing. A specimen was taken from this flock on Aug. 24, and thereafter this fishing duck was regularly noted. When one of the flock succeeded in capturing a fish, the others would pursue the successful fisher, and a playful scuffle for possession of the prey would ensue, in which the victim was generally dismembered by the harsh teeth of the captors.

131. HOODED MERGANSER, *Lophodytes cucullatus* (Linn.)

On July 15, 1901, a female hooded merganser was taken at Mud Lake. This was the only specimen noted, though this merganser is common in this region as a regular resident.

132. MALLARD, *Anas boschas* Linn.

This fine duck is a common migrant at the upper end of Flathead Lake, appearing in flocks there as elsewhere. A specimen was taken on Aug. 24. Numbers were noted at the right of the mouth of Flathead River, where a small cove offered them convenient anchorage. It often breeds in the neighborhood.

139. GREEN-WINGED TEAL, *Anas carolinensis* Gmel.

A flock of green-winged teal appeared on Daphnia Pond about the middle of August, and a specimen was taken on August 17. Thereafter this teal was noted regularly on the pond, and in the mouth of Swan River.

143. PINTAIL, *Dafila acuta* (Linn.)

The pintail doubtless breeds at the north end of Flathead Lake, as specimens were regularly noted in the swampy area between Swan River and Flathead River, during our observations in June. Numbers were accumulating in the cove west of the mouth of Flathead River during the latter days of August, with the mallard, green-winged teal, American golden-eye, American merganser, and other species.

144. WOOD DUCK, *Aix sponsa* (Linn.)

A brood of young wood ducks appeared on the grassy slough in the swamp-woods between Swan River and Flathead River, and a young male was taken, July 31, 1901. Residents of the neighborhood report that the wood duck is disappearing, being seen much less frequently than it was several years ago.

151 AMERICAN GOLDEN-EYE, *Glaucionetta clangula americana* (Bonap.)

A pair of American golden-eyes were seen about Sin-yale-a-min Lake at various times, and one specimen was taken. On the little pond in the ravine to the southwest, a family of

American golden-eye was found, and several specimens of the young were taken with the parent birds. Every little sheet of water, along whose margin cavities can be found in convenient trunks, seems to have its family of American golden-eye. This species appeared to be by far the most abundant of the summer ducks in the Flathead region.

A common breeder at the north end of Flathead Lake, and on the adjacent ponds. Specimens were frequently taken, in June and in August. The numbers are increased by migrants toward the end of August.

153. BUFFLE-HEAD, *Charionetta albeola* (Linn.)

On July 30, 1901, a flock of young buffle-heads was noted at the head of Flathead Lake, and a specimen was taken for identification. It is likely that broods are commonly reared along the lakeshore, as several families are regularly observed to appear on the lake at the appropriate season.

172. CANADA GOOSE, *Branta canadensis* (Linn.)

Abundant during the migration early in August, appearing in flocks of ten to twenty on the sand-bars near the mouth of Flathead River. When approached by the observer, a flock will line up in single file along the shore before taking flight, and thus take wing while the observer is beyond shotgun range.

190. AMERICAN BITTERN, *Botaurus lentiginosus* (Montag.)

An American bittern was seen at nightfall on June 25, 1901, flying low over our camp at Post Creek. On July 16, 1901, a specimen of American bittern was taken in the reedy bog fringing Mud Lake.

214. SORA, *Porzana carolina* (Linn.)

The Sora occurs commonly on the reedy ponds and marshy areas of the lake shore. A pair inhabited a small weedy opening in the swampy woods between Swan River and Flathead River, and others were noted at Daphnia Pond. Specimens were taken at both places.

223. NORTHERN PHALAROPE, *Phalaropus lobatus* (Linn.)

Occurs regularly on the migrations at the north end of Flathead Lake. A specimen was taken near the mouth of Swan River, August 27. It generally appears with the yellow-legs, swimming along the water's edge somewhat beyond the depth of its companion, and feeding near it.

230. WILSON'S SNIPE, *Gallinago delicata* (Ord.)

This "Jacksnipe" is noted commonly near Flathead Lake. A specimen was taken on August 18, on the shore at the right of the mouth of Swan River.

241. BAIRD'S SANDPIPER, *Tringa bairdii* (Coues)

Appears regularly along the lake shore about the middle of August, in flocks of fifteen to twenty, feeding along the water's edge in restless, irregular movement, and taking flight simultaneously upon sufficient alarm. In air the flock retains a close formation, sweeping low above the water, and generally flying some distance before alighting, if previously alarmed.

248. SANDERLING, *Calidris arenaria* (Linn.)

Regular migrant at the north end of Flathead Lake. Specimens were taken near the mouth of Swan River, August 29. It frequents the reedy shores, in company with the spotted sandpiper, Baird's sandpiper, and other shore birds.

z54. GREATER YELLOW-LEGS, *Totanus melanoleucus* (Gmel.)

Noted commonly on the pools of the Reservation, and along the creeks. A pair were taken on one of the pools when we crossed from Lake McDonald to Post Creek. Specimens were noted at Crow Creek, and also at the foot of Flathead Lake. Common near the mouth of Swan River, on the sand-bars near the boat landing, and also on the sandy shores between Swan River and Flathead River.

255. YELLOW-LEGS, *Totanus flavipes* (Gmel.)

Usually seen in company with *Totanus melanoleucus*. Specimens were taken on the pools of the Reservation. Common at the foot of Flathead Lake. Also common near the mouth of Swan River.

256. SOLITARY SANDPIPER, *Totanus solitarius* (Wils.)

This sandpiper was common on the Reservation, generally along the creeks. Specimens were taken on Crow Creek. In its habits it closely resembles the spotted sandpiper, though its larger size aids in distinguishing it from the latter. Two specimens were taken near the mouth of Swan River, August 8, and it was regularly noted in our daily lists.

261. BARTRAMIAN SANDPIPER, *Bartramia longicauda* (Bechst.)

The Bartramian sandpiper was found locally distributed over the Reservation, meadows near ranch-houses being the favored haunts. A family or small colony inhabited a meadow on Mr. Felsman's ranch, near Sin-yale-a-min Lake, where a specimen was taken, June 21, 1901. On the same day a young Bartramian sandpiper, yet in downy plumage, was captured alive on the prairie between Post Creek and Mt. MacDonald. Another pair of these birds was found on a ranch near the foot of Flathead Lake, and several miles up the Lake a small colony or family was noted, June 26.

263. SPOTTED SANDPIPER, *Actitis macularia* (Linn.)

Noted everywhere in the localities visited. Abundant as a summer resident along the north end of Flathead Lake. Nests were frequently found in June on the sand-bars.

264. LONG-BILLED CURLEW, *Numenius longirostris* Wils.

Young birds of this species were running about over the prairie when we crossed from Lake McDonald to Flathead Lake. Several young of the year were taken. The curlew was common in the vicinity of Flathead Lake, near Polson, where flocks were forming on the prairies.

273. KILLDEER, *Aegialitis vocifera* (Linn.)

The killdeer was common throughout the Reservation. Specimens were noted on the pools, and along the streams, as well as at Flathead Lake.

Frequently observed near the boat landing, on the gravelly bars of Swan River. Specimens were taken on August 8, and regularly noted thereafter.

289. BOB-WHITE, *Colinus virginianus* (Linn.)

This fine game bird has been successfully introduced in the locality between Flathead Lake and Kalispell, where the variations of meadow, grainfield, and brushy ravine are particularly suitable to the needs of the bob-white. His mellow whistle is delightfully gratifying to the ears of those who knew him in his native habitat, and we may hope that he will take kindly to his trans-mountain conditions. Friends of this partridge should see that he is permitted to adjust himself fully to his new environments and to multiply in peace, before he falls a prey to the desire to kill. No true sportman will molest the bob-white whose rich piping greets his ears, nor will he raise his destructive gun when a startled bird may whir away from the covert at his feet, until the numbers are sufficiently great to warrant the taking of an occasional bird.

297 b. RICHARDSON'S GROUSE, *Dendragapus obscurus richardsonii* (Dougl.)

This form of the sooty grouse was common in the vicinity of the Sin-yale-a-min Lake. Specimens were frequently taken. In a trip to the summit of Sin-yale-a-min Peak, on July 12, chicks about three days old were taken with the female, at an altitude of 7,000 feet. The chicks were easily caught with the hand. Several similar instances indicate that this grouse nests much later than is usually given in data regarding its nidification, or that it is generally unfortunate in the issue of its earlier attempts.

This grouse was common on the slopes leading up toward Mt. McDonald, and elsewhere on the bushy hillsides. Specimens were frequently taken.

On June 23, a fine male Richardson's grouse was taken on the eastern side of the ridge east of Daphnia Pond. He was feeding on the red berries growing in profusion on the hillside, having his crop full when taken. When disturbed, he strutted among the clumps of sprouts, spreading his large, fan-like black tail, and puffing out the naked air-sacs on the sides of his neck. He did not attempt to fly or to make any effort to escape.

On August 16, a female Richardson's grouse was taken on the same hillside.

299. FRANKLIN'S GROUSE, *Dendragapus franklinii* (Dougl.)

Franklin's grouse was common in the vicinity of Lake McDonald. A female with young about two weeks old was taken on Mt. McDonald at an altitude of 7,500 feet. Other specimens were taken near the lake. This grouse is the "fool hen" of popular reputation, by which name it is very generally known in this region.

300 b. GRAY RUFFED GROUSE, *Bonasa umbellus umbelloides* (Dougl.)

The gray ruffed grouse was found as a common resident of the thickets near the lakes. At the time of our first observations, females with young just beginning to fly were frequently flushed. When disturbed with her brood, the female sometimes utters a strange hissing noise, and running at her disturber with inflated air-sacs and outspread wings, she presents a very peculiar appearance. At such times, when she does not threaten the observer, she slinks among the bushes uttering a cat-like "meow", which is a close counterpart of the characteristic feline cry. Toward the close of the warm July afternoons, these birds were most likely to be found near the water's edge; at other hours of the day, they generally resorted to the clumps of small firs.

Abundant in the swampy area between Swan River and Flathead River, where several broods were noted in June; also on the ridges east of the lake, where several families were found. By the first of August, young birds were taking to the trees and higher bushes when disturbed.

308 a. COLUMBIAN SHARP-TAILED GROUSE, *Pediocaetes phasianellus columbianus* (Ord.)

This grouse was observed in the meadows near Crow Creek, where it appeared to be common as elsewhere in the cultivated bottoms of the state. Hillsides near water-courses, along which are hay meadows and grainfields, are the summer resorts of this fine gamebird of the Northwest.

Abundant on the prairie between Flathead Lake and Kalispell. On Aug. 30, a large flock was seen beside the road a short distance beyond Holt. The open districts north of the lake form the regular resorts of this common gamebird, and every ranch doubtless has its flock of "chickens".

316. MOURNING DOVE, *Zenaidura macroura* (Linn.)

The mourning dove is not uncommonly noted in the Reservation, being observed most generally near the water-courses. We listed several specimens at Crow Creek, though no others were seen until we reached the head of the lake, and there only sparingly. It is evidently nowhere abundant in this portion of its range. Specimens were regularly noted along the road from the Station to Holt, near the margin of the swampy region between Swan River and Flathead River.

331. MARSH HAWK, *Circus hudsonius* (Linn.)

The marsh hawk is common along the foot of Flathead Lake. We did not note it elsewhere in the Reservation, though it is undoubtedly found at suitable localities along the water-courses.

332. SHARP-SHINNED HAWK, *Accipiter velox* (Wils.)

This spirited little accipiter was found regularly near McDonald Lake. On one occasion a specimen darting around a clump of dwarf trees nearly flew into my arms; seeing me, he quickly darted upward and tried to escape, but a fortunate shot brought him to earth.

This hawk was found nesting in the swamp woods between Swan River and Flathead River, where a female was taken when flushed from her nest, in which were four eggs, July 3. On August 16, a male sharp-shinned hawk was taken on the bushy ridge east of the road leading to Daphnia Pond.

333. COOPER'S HAWK, *Accipiter cooperii* (Bonap.)

Cooper's hawk was common along the cliff east of McDonald Lake. We frequently observed them feeding young, or heard the cries of the young as the elders brought supplies to their rocky eyries. Once we climbed about half way up the cliff toward a nest of young birds whose cries attracted us; but as we neared the site the elders quitted the place and the young birds ceased their cries, thus defeating our object of finding the nest.

On August 14, a male Cooper's hawk was taken on the road leading from the bridge up Swan River. Specimens were taken successively on August 22 and 23, on the ranch at the right of the mouth of Swan River. This hawk was not noted during our observations in June.

337 b. WESTERN RED-TAIL, *Buteo borealis calurus*(Cass.)

This fine large hawk was found breeding along the eastern shore of McDonald Lake. One specimen was taken.

A mutilated specimen of the western red-tail was found in the road through the woods leading to the point at the mouth of Swan River, August 22. It had probably been shot by one of the parties staying at the Club houses, and had fallen or been dragged there by one of the dogs scouring the woods for game.

347 a. AMERICAN ROUGH-LEGGED HAWK, *Archibuteo lagopus sancti-johannis* (Gmel.)

The American rough-legged hawk was commonly seen soaring overhead above the woods and hills east of the lower end of Flathead Lake. Several efforts were made to secure a specimen, even to scaling the cliff in hopes of getting a shot, but the game was always beyond reach.

349. GOLDEN EAGLE, *Aquila chrysaetos* (Linn.)

The Mission Mountains and adjacent regions offer congenial resorts for the golden eagle. Frequently it was observed soaring over the ranges, but no specimen was taken, though effort was frequently made to get within range of one. A fine specimen was observed feeding on a carcass and it allowed us to ride within fair view of it, but departed before we were within effective shotgun range.

352. BALD EAGLE, *Haliaeetus leucocephalus* (Linn.)

Though not noted by our party, the bald eagle was reported on Swan Lake near its head, by Mr. Leffingwell, who took a fine specimen there during our stay at the Station in the latter part of August. His accurate knowledge of this species warrants the including of the bald eagle in this list upon his identification.

360 a. DESERT SPARROW HAWK, *Falco sparverious deserticolus* Mearns.

This species did not appear to be as common near Sin-yale-a-min Lake as elsewhere in its usual range. We noted it occasionally in our daily lists. In our ascent of Mt. Sin-yale-a-min, this little falcon was seen at an altitude of 7,700 feet, pursued by five or six pine siskins. It was found regularly on the hillsides, though not abundantly, but was common everywhere over the prairies of the Reservation.

The sparrow hawk was not uncommon in the vicinity of Lake McDonald. It was noted most frequently near the outlet of the lake, and along the cliff on the eastern shore. No specimens were taken here. A small butte near our camp at Crow Creek was used as a sort of watch tower by the sparrow hawks, and generally several would be flushed when we climbed to its rocky summit.

Abundant on the ranches near Flathead Lake, preferring the edges of the woods. It resorts to rail fences, flying from one station to another ahead of the observer; or from a watch tower in the top of isolated trees in the meadows it scans the subjacent ground for venturesome mice, grasshoppers, crickets, and similar prey.

364. AMERICAN OSPREY, *Pandion haliaetus carolinensis* (Gmel.)

The osprey was noted only occasionally in our daily lists at Sin-yale-a-min Lake. It is likely that a pair of ospreys inhabited the ravine leading to the little pond, for the specimens we noted were generally seen in that locality. The lake did not appear to be frequented to any extent by the osprey, though it certainly afforded a generous supply of fish, which forms almost the entire bill of fare of this species. The inlet and outlet of the lake, which are stocked abundantly with trout, doubtless offer easier larders than the deeper waters of the lake.

Common at Flathead Lake, especially near the mouth of Pend d' Orielle River, Swan River, and Flathead River. A family had possession of a large nest at the top of a tall, naked stub near the river on the Helena Club grounds, (see Plate VIII.), and two specimens were taken from this family during our stay in August. The osprey was also found very commonly on Swan Lake, where we spent two days near the foot, August 20 and 21.

366. AMERICAN LONG-EARED OWL, *Asio wilsonianus* (Less.)

The long-eared owl, being more generally nocturnal in its habits than the other owls, is less frequently noted than others. Only one specimen was observed, which was in the dark swamp-woods of the Jocko River at Selish.

373 e. ROCKY MOUNTAIN SCREECH OWL, *Megascops asio maxwelliae* (Ridgw.)

A specimen of this screech owl was taken on Post Creek, where it was shot from our camp as it was perched in a dead tree beside the creek, having begun its nocturnal foraging soon after dusk.

375 a. WESTERN HORNED OWL, *Bubo virginianus subarticus* (Hoy.)

This form of the great horned owl apears to be common in the parts of the Flathead region included in our itinerary. The dense woodland are peculiarly adapted to this powerful nocturnal marauder. It manifests its presence more particularly in the fall and winter months, when many specimens are captured by the ranchers. The only individual of this species we saw at McDonald Lake was taking an evening outing along the low shore near the outlet, resting occasionally on the summit of some tall stub ere continuing his perambulations.

The western horned owl was reported as common along Crow Creek, though we did not take any specimens. The abundance of food would imply its presence. For some reason the Raptores, which we expected to find at this station, seemed less common than usual.

On June 22, a specimen was seen at Estey's Pond. On August 6, a fine specimen was brought to the Station by Mr. Estey, who reported the species very common on his ranch. No notes were made concerning its occurrence nearer the Station.

390. BELTED KINGFISHER, *Ceryle alcyon* (Linn.)

The belted kingfisher is a common resident in summer along the shore of Sin-yale-a-min Lake. No specimens were taken, but were easily accessible, and were noted in all our daily lists. The clear waters of the lake furnished this avian fisher very attractive accommodations. By measurement it was found that we could see objects to the depth of thirty-five feet, and the schools of minnows playing near the shore were easy prey for the kingfisher. However, the kingfisher is not always successful in its dashes for its finny victim; in my opinion it fails more frequently than it succeeds. It always seizes its prey with its bill, and frequently finds it necessary to thrash its victim against a stake or branch before it can stow the morsel away in its gullet.

It was daily noted plying its vocation near the inlet of Lake McDonald. At the mouth of the inlet the fishing was particularly fine, and the fact that the water from the ravine above the lake entered the reservoir by several small mouths rendered the sport unusually excellent. It appeared that only one pair of kingfishers claimed the fishing rights of this lake. No specimens were taken.

The kingfisher was seen at all times near the Station, frequenting the banks of Swan River near its mouth, and especially near the boat landing, where the shallower water afforded easier fishing grounds than the more turbulent flow of the river proper. This species was also found abundantly on Swan Lake, where we took several specimens while standing in our camp at the foot of the lake. Though we had reason to believe that there were no fish in Daphnia Pond, and few in Estey's Pond, the kingfisher was observed at both stations, and we concluded that the numerous frogs along the margins of the ponds offered the avian fisherman easier prey than the sport at Swan River.

393 d. CABANIS'S WOODPECKER, *Dryobates villosus hyloscopus* (Cab.)

This species or form of the hairy woodpecker is not uncommon in the vicinity of Sin-yale-a-min Lake. Specimens were generally noted and one was taken. It is doubtless a permanent resident.

A specimen was noted visiting the large pine trees at our Crow Creek camp. It was not included in our list for the foot of Flathead Lake. Doubtless regularly found in the tall trees of the water-courses. Specimens were frequently taken near the Station at Flathead Lake.

394 b. BATCHELDER'S WOODPECKER, *Dryobates pubescens oreoecus* Batch.

The downy woodpecker in this Rocky Mountain form did not appear to be common in the immediate vicinity of Sin-yale-a-min Lake. No specimens were taken, and those noted were more frequently heard than seen. More thorough examination of the locality might disclose its presence in greater proportion than our notes indicate. It is common in the vicinity of the Biological Station.

400. ARCTIC THREE-TOED WOODPECKER, *Picoides arcticus* (Swains.)

noted as commonly as the Alpine three-toed woodpecker.
A specimen was taken at Swan Lake, August 3, 1901.

401 b. ALPINE THREE-TOED WOODPECKER, *Picoides americanus dorsalis* Baird.

One specimen of this three-toed woodpecker, a young male, was taken in the woods north of the lake. The vigorous, deliberate, though intermittent tapping of this woodpecker is a pretty certain index of its presence near the observer; however, the wary nature of the woodland carpenter leads him to desist when the collector approaches his station. This specimen allowed me to walk past without my discovering him; but began his tapping immediately after my back was turned. Not uncommon near the mouth of Swan River. A specimen was taken in the woods east of the Club grounds, Aug. 16.

402 a. RED-NAPED SAPSUCKER, *Sphyrapicus varius nuchalis* Baird.

On the day of our arrival at Sin-yale-a-min Lake, and on the following day, a pair of red-naped sapsuckers claimed quarters along the trail near our camp, and were frequently observed sporting on the tree-trunks, uttering their harsh calls as they flitted restlessly about their claimed domains. On the second day, a party of Indian campers stationed themselves near the place, and used the trail for their racing and shooting frolics. The sapsuckers disappeared, and we made no further notes regarding the presence of this interesting species. Unlike other members of the woodpecker group, this sapsucker frequents the lower story of the woods, doubtless because of its fondness for the sap-laden inner fibers of the bark which it finds nearer the bases of the trunks. Its nesting site is also much lower or nearer the ground than the average of those of the other woodpeckers.

It is common in the woodlands in the vicinity of Lake McDonald. One specimen was taken, and it was regularly included in our daily lists. Its harsh, impatient call betokens its presence in any neighborhood, its noisy ways being decidedly in contrast with those of the three-toed woodpecker.

A pair of red-naped sapsuckers reared a brood in the weedy area in the swamp woods at the right of the mouth of Swan River, where specimens were frequently taken. Also frequently observed in the woods east of the Helena Club grounds. This species was apparently more frequently noted than either the Alpine three-toed woodpecker, Cabanis's woodpecker, or Batchelder's woodpecker, in the vicinity of the Station.

405. PILEATED WOODPECKER, *Ceophloeus pileatus* (Linn.)

The pileated woodpecker was not uncommon in the woods near the Station, and occasionally a specimen would even visit the Station grounds, uttering its loud flicker-like call from the top of one of the taller trees. On August 15 a specimen was taken in one of the trees on the western side of the grounds. This woodpecker was frequently heard in the swamp woods at the right of Swan River, and even more frequently in the Helena Club grounds at the left of the river. Two specimens were taken on August 27, in the woods west of the road leading to Daphnia Pond. Both were tapping on medium-sized trunks, at points about half way up the boles. The shooting we had done in the woods during the preceding three weeks did not appear to have had any effect in frightening away this wary woodpecker from the old landmarks. However, the woodsman's axe will doubtless hasten this undesirable outcome.

This lordly inhabitant of the primeval woodlands is common in the vicinity of Sin-yale-a-min Lake. A pair had a home in the ravine leading westward from the lake. Their favorite haunts were tall denuded pines and tamaracks, though they were not often seen near the summits of the boles, apparently preferring a middle station. Their loud, resounding tapping generally disclosed their presence, together with their loud, vibrant, flicker-like call. Our frequent shooting in the neighborhood and in the ravine where they made their headquarters did not seem to disturb them, though when we tried to stalk them they managed to keep out of range, silently flapping away when we aproached, so that no specimens were taken at this camp.

Likewise at McDonald Lake, after we had been in camp some days and had been shooting in the immediate neighborhood at all times during our stay, two specimens, an old female and a young male, were taken within a hundred yards of the camp.

408. LEWIS'S WOODPECKER, *Melanerpes torquatus* (Wils.)

This peculiar woodpecker was common in the woods near the outlet of Lake McDonald. It prefers the largest pines, from which it will fly out and capture an insect in air as expertly as a kingbird or other flycatcher, and return to its chosen station. There is a degree of wary secretiveness in its nature, however, for when an observer is near, it will remain silently lurking in the top of the tree until the patience of the observer is likely to be exhausted.

A pair were seen feeding young birds in a hole about fifty feet from the ground in a living pine, July 28, at Post Creek. This woodpecker was a common visitor to our camp at Crow Creek. We also noted it among the scrubby haw trees near our camp at the foot of Flathead Lake.

On the day of our first arrival at the Station, June 14, Lewis's woodpecker was a noticeable visitor to the Station grounds, and two specimens, which were making frequent sallies into the air from the tops of tall dead trees in quest of passing insects, were taken as a tribute to our curiosity in regard to this peculiar woodpecker. Upon our return to the Station, in the first week of August, Lewis's woodpecker was abundantly represented by specimens along the road leading toward Holt, where they would sit on the rail fences like crows or robins, each sitting quite upright and bunched together like an owl a-perch. On August 16 a specimen was taken that had one inner toe missing, which had apparently been severed close to the place of insertion. Around Daphnia Pond this woodpecker was also abundant, as well as at other stations in the neighborhood.

413. RED-SHAFTED FLICKER, *Colaptes cafer* (Gmel.)

This flicker is common everywhere in localities visited where trees of any size can be found. On one occasion at Sin-yale-a-min Lake, three red-shafted flickers were observed flirting and coquetting at the top of a tall denuded stub. In our ascent of a ridge of Mt. McDonald, this flicker was noted at an altitude of 7,700 feet. It is the most common woodpecker in the vicinity of McDonald Lake. In the wooded localities in the open regions of the Reservation, the red-shafted flicker appears to be less numerously represented than the Lewis woodpecker.

420 a. WESTERN NIGHTHAWK, *Chordeiles virginianus henryi* (Cass.)

The western nighthawk was not common at Sin-yale-a-min Lake, though specimens were noted occasionally in twilight flight. No specimens were taken.

It was commonly seen flying about at nightfall at McDonald Lake. One specimen was taken as it was flying to and fro over the water at early dusk.

Abundant in the vicinity of Crow Creek. A small butte near our camp was a favorite haunt of the nighthawk, and from its top we secured several specimens at nightfall. We also found it abundant at the foot of Flathead Lake, and at the upper end as well, where it was found breeding.

433. RUFOUS HUMMINGBIRD, *Selasphorus rufus* (Gmel.)

This hummingbird was a common visitor to our camp, and was noted regularly near the lakes. A female was taken while sitting on a naked branch near our tent, at McDonald Lake.

Very common in the vicinity of the Station. On the day of our arrival, a male rufous hummingbird was taken in the woods across the road from the Station, and others were noted. In the swampy woods between Swan and Flathead Rivers, this hummingbird was frequently observed darting at Traill's and other flycatchers, and pursuing them angrily for short distances, as though the latter were intruding upon its domains. Later in the season, August 11, a family was noted visiting the snowberry, a species of honeysuckle, and also feeding on the giant hyssop growing rankly beside the fences near the Station grounds.

436. CALLIOPE HUMMINGBIRD, *Stellula calliope* Gould.

The calliope hummingbird appeared to be common along the cliff east of McDonald Lake. It was noted particularly in the vicinity of the waterfalls that dashed from the crevices of the cliff, where it would alight within a few feet of the observer, sitting on some dead twig to preen its plumage or rest after a journey along the rocky wall.

A family of calliope hummingbird was observed on the eastern side of the ridge east of the Helena Club grounds. Both elders and young were darting about from bush to bush, and apparently had one or two chosen stations for perching, generally bare twigs projecting from the periphery of a maple clump. The male parent bird was shot, and I had turned from picking him up, when another of the family was seen perched upon the same twig. No other specimens of this hummingbird were noted near the Station.

444. KINGBIRD, *Tyrannus tyrannus* (Linn.)

Abundant in the willows of Flathead Lake shore at the northern end, and also near Daphnia Pond. Nests were observed in the early season.

The kingbird was abundant along the streams of the reservation, and also along the foot of Flathead Lake. Many pairs were yet feeding young birds in the nest.

It was not observed at the smaller mountain lakes.

447. ARKANSAS KINGBIRD, *Tyrannus verticalis* Say.

This noisy, handsome kingbird was abundant about the ranches of the Reservation. It is very noticeable in its movements and demonstrative in manners, having a short musical twitter which it utters generally upon alighting, accompanying the twitter with a fluttering or quivering movement of the wings. Like its congener the kingbird, it is very pugnacious in its disposition, chasing away the magpie or other invader of its domains. Its calls is vigorous in enunciation, resembling the syllable "ki". We noted it at Post Creek, Crow Creek, and at the foot of Flathead Lake, at all of which places it was manifestly prominent because of young birds lately upon the wing. The familiarity of this kingbird is measurably beyond that of *Tyrannus tyrannus*, as it will boldly establish itself in the midst of the busiest scenes. A pair had a nest on a cross-piece upon a telephone pole on Main Street in Missoula, on one of the busiest corners in the city. There the female would sit jauntily while people were hurrying along below her; and there the male would visit her with refreshing tid-bits regardless of the evidences of activity around their chosen domain.

459. OLIVE-SIDED FLYCATCHER, *Contopus borealis* (Swain.)

First observed on July 11, 1901, on the ridge leading to MacDougal Peak, at an altitude of 6,500 feet. A specimen was sitting in the bare top of a tall tree, uttering its harsh, querulous call. Though not then taken, it was readily identified by the white flank-tufts which show prominently between the wings and back when the bird is at rest. On August 10, 1901, a specimen was taken in the woods at the base of MacDougal Peak.

462. WESTERN WOOD PEWEE, *Contopus richardsonii* (Swains.)

This interesting species was common on the hillsides near the shores of the mountain lakes. Its sharp call, though suggestive of the plaint of the wood pewee of eastern regions, is quite different from the far-away-sounding call of the latter, being uttered in a more impatient, garrulous manner. The western species appears to prefer higher stations as its lookout, consequently seeking its food in a higher story of the forest than its eastern congener, and building its nest in sites higher in the trees. It generally chooses a station in a tall tree on a bare limb above the middle point, and there utters its sharp, querulous call, making occasional sallies into the air to capture passing insects. Trees on bushy hillsides are its most favored resorts.

466. TRAILL'S FLYCATCHER, *Empidonax traillii* (Aud.)

Common in the woods and bushy localities during August. It was not observed during our first visit to the Station. This flycatcher frequents a lower story than does the western wood pewee, being seldom observed higher than the middle of medium-sized trees, and usually preferring the clumps of maple and willow of fire-swept districts. It was most frequently noted in the woods between Swan River and Flathead River. Common near McDonald Lake.

469. WRIGHT'S FLYCATCHER, *Empidonax wrightii* Baird.

No specimens of this little flycatcher were taken at Sin-yale-a-min Lake, but it appeared to be common on the hillsides south of the lake, where there was an extended growth of bushes and younger trees. There it could doubtless be found nesting in the breeding season, though no nests of the season were noted. In fact, it seemed that few birds had nested near this lake, judging by the absence of nests for the year. I am of the opinion that the lake is used by the birds more as a place for occasional resort than as a breeding ground.

Wright's flycatcher was found nesting in bushy localities near the Station, generally inhabiting the clumps of maple sprouts in the edges of the heavier woods or on ridges where former fires had prostrated the taller growth and given place to bushes. Four nests were found during the June collecting, but this flycatcher was not observed during our visit to the same localities in August.

474 c. DESERT HORNED LARK, *Otocoris alpestris arenicola* Hensh.

This horned lark was abundant on the prairie regions of the Reservation, and is doubtless the prevailing form in summer.

The pallid horned lark, *Otocoris alpestris leucolaema* (Coues), is probably the prevailing winter form in Montana. The desert horned lark was found regularly from the base of Mt. McDonald to the shore of Flathead Lake, generally feeding along the roads, or flitting about in the vicinity of the pools. Most of the specimens taken were young of the year.

475. AMERICAN MAGPIE, *Pica pica hudsonica* (Sab.)

Abundant in the thickets of the foothills and along the streams; also in the dwarf trees along the shore of Flathead Lake. Many nests of the spring were noted, some high in the pines, though most of them were within reach without climbing, in dwarf haws and similar growth.

The magpie was not listed at Sin-yale-a-min Lake, but it was noted at McDonald Lake.

478 c. BLACK-HEADED JAY, *Cyanocitta stelleri annectens* Baird.

This mountain form of Steller's jay was quite common in the vicinity of Sin-yale-a-min and McDonald Lake. Such specimens as were wanted were taken, for they did not manifest a suspicious nature when the collector was near. All our specimens were in very poor plumage, undergoing the moult during our visit to the lake.

484 a. ROCKY MOUNTAIN JAY, *Perisoreus cannadensis capitalis* Ridgw.

The Canada jay in its Rocky Mountain form did not seem to be common near our itinerary. One specimen was taken at Sin-yale-a-min Lake while lurking in a fir clump near where we were sitting, on the southern shore of the lake; its curiosity perhaps led it to betray its presence. No other notes were made regarding its occurrence.

486. AMERICAN RAVEN, *Corvus corax sinuatus* (Wagl.)

A family of this species had a home up the hillside on the western shore of McDonald Lake. The noisy croakings were heard throughout our visit, and the birds were frequently seen flying over the lake. Several unsuccessful attempts were made to secure specimens. The American raven appears to be generally distributed over the Flathead region.

It was represented near the Station by a pair that frequented the swampy woods at the right of the mouth of Swan River. These were noted regularly when we visited the locality named, and frequent efforts were made to capture one, but the wary creatures invariably kept well beyond shotgun range, generally flying away with hoarse croakings to another part of their claimed domain when we entered the area anywhere near them.

488. AMERICAN CROW, *Corvus americanus* Aud.

Not listed at Sin-yale-a-min Lake, but noted frequently in the woods near the inlet of McDonald Lake. On one occasion four or five were observed in a group in the tree-tops at the upper end of McDonald Lake.

It was regularly noted in our lists, both at Crow Creek and at the foot of Flathead Lake. It was most generally observed in the vicinity of the water-courses, where the fringing trees offered more congenial resorts than the bare prairies of the intermediate areas.

The American crow occurs only occasionally near the Station. On June 30, one was seen flying over the station grounds. No other notes were made concerning its occurrence in the vicinity of the Station.

491. CLARKE'S NUTCRACKER, *Nucifraga columbiana* (Wils.)

No specimens of Clarke's nutcracker were seen except in our ascent of the peak near Sin-yale-a-min Mountain, when the first nutcrackers were noted at an altitude of 4,700 feet; thence they were observed while we were in the timber, which ceased at an elevation of 7,700 feet, owing to the bare, rocky character of the ridge forming the higher regions of the mountain. The hillsides surrounding the lake are probably congenial resorts of the nutcracker, but as our observations were practically confined to the immediate margins of the lake, no other record concerning this species was made.

494. BOBOLINK, *Dolichonyx oryzivorus* (Linn.)

A troop of bobolinks visited our camp at Crow Creek, doubtless attracted by the shorn grainfields and meadows near the stream. Their metallic "clink" revealed their presence, and several specimens were taken. They are likely quite common in the creek bottoms in the fall migration. The bobolink of this region is now placed in the subspecies *albinucha*.

495. COWBIRD, *Molothrus ater* (Bodd.)

The cowbird was only occasionally noted in our lists, and then only at Crow Creek and the foot of Flathead Lake. One specimen, a young of the year, was taken at our camp at the outlet of Flathead Lake. This species seems to occur in smaller ratio in this region than might be fancied from knowledge of its wide distribution.

498. RED-WINGED BLACKBIRD, *Agelaius phoeniceus* (Linn.)

Common at suitable places near the head of Flathead Lake. It was found nesting in the reeds at Daphnia Pond, where a small colony had established itself. Very few specimens were seen near the pond in August.

501 b. WESTERN MEADOWLARK, *Sturnella magna neglecta* (Aud.)

This meadowlark was abundant in the prairie regions, especially in the neighborhood of the ranches and water-courses, everywhere from the foothills to the shore of Flathead Lake. It was most abundant near the stubble fields in the vicinity of the lake.

508. BULLOCK'S ORIOLE, *Icterus bullocki* (Swains.)

We found Bullock's oriole common in the groves at the foot of Flathead Lake. Nests of the year were observed, and several specimens of adult birds were taken.

510. BREWER'S BLACKBIRD, *Scolecophagus cyanocephalus* (Wagl.)

Abundant everywhere in the vicinity of the ranches and water-courses. Flocks were forming for summer feeding and fall migration, and were much in evidence near the lake shore.

514 a. WESTERN EVENING GROSBEAK, *Coccothraustes vespertinus montanus* (Ridgw.)

Comparatively common in the vicinity of Swan River and Flathead River, in the swampy woods. Specimens were seen and heard every day during our visit in June, and it is very probable that it nests in the locality, though no evidence of such nesting was observed. Specimens were frequently taken, both in June and in August. The fruit ranches in the vicinity of the woods mentioned appear to offer unusual attractions to the birds of the neighborhood; our first specimen of this grosbeak was taken as it was being allured by the store of raspberries at hand. The call of this species is closely imitative of that of a young chicken; if intensified and greatly increased in volume it would resemble the cry of the osprey.

This handsome bird was common along Crow Creek, where a specimen was taken immediately upon our arrival, before our camp was established. The tall pines in the neighborhood were regular stations for this grosbeak, and frequently a troop of six or eight would take possession of a treetop and chirp cheerily for a few minutes. It is not likely that the grosbeak is found far from the streamsides in the prairie region of the Reservation, as trees and thickets are its usual resorts.

518. CASSIN'S PURPLE FINCH, *Carpodacus cassini* Baird.

This purple finch does not appear to be common in the Flathead Lake region. A male was taken at Swan Lake on August 3, 1901. It was resorting to the grounds around an unoccupied cabin, associating with pine siskins in gleaning from the dooryard. Only one specimen was seen.

521. AMERICAN CROSSBILL, *Loxia curvirostra minor* (Brehm)

Along the immediate shore of Sin-yale-a-min Lake, the crossbills were not often noted; but around the pond mentioned as being southeast of the lake, the American crossbills were abundant, frequenting the tops of the tall trees in small flocks, and announcing their presence by their sharp chirps. Both adult specimens and young of the year were taken, always from the summits of the loftiest trees.

The American crossbill was regularly noted at Crow Creek and at the foot of Flathead Lake. Like the evening grosbeak, it is partial to the streamsides in the prairie regions, moving restlessly from place to place in troops of small numbers, and chirping merrily from the treetops.

It is common in the vicinity of the Station, frequenting the tops of the tall trees in small flocks, uttering short, sharp metallic chirps. It generally associates with the pine siskin and other frequenters of the upper story of the woods. It is represented more numerously in the fall, and during the latter part of August we found it abundant in the neighborhood of Daphnia Pond and Estey's Pond, moving about capriciously from one treetop to another and chattering its enjoyment in the liberty of its wildwood domain.

533. PINE SISKIN, *Spinus pinus* (Wils.)

The pine siskin was commonly seen in the tops of the tallest trees, though at Sin-yale-a-min Lake and McDonald Lake it is more generally heard passing overhead, uttering its goldfinch-like call, or chirping vigorously to its fellows. It is a social creature, and its familiarity will lead it to alight in the midst of the camp to glean refuse from the tables. The only specimen taken at Sin-yale-a-min Lake was shot in camp while it was picking up morsels of food near the cooking-tent.

This animated resident of the higher woodlands was abundant near the Station. During our visit in June, the pine siskin was one of the most noticeable birds of the neighborhood, flitting in sportive enjoyment among the treetops, and uttering a loud sibilant chirping as it bounded from tree to tree. Frequently specimens visited our camp and alighted at the door of our tent, to glean from the refuse of the table, manifesting all the familiarity of the chipping sparrow. One evening about sunset, while I was exploring the woods on the Helena Club grounds, a nest in the top of a small fir tree caught my attention. Giving the tree a vigorous shake to alarm any occupant of the nest, I was surprised to see a brood or flock of pine siskins, five or six in number, flutter out of the nest and away from the neighborhood, chattering with lively scolding at being thus rudely routed from their home.

The pine siskin is commoner up the mountain slopes than near the lake shore. We noted it at all elevations up to 9,200 feet. Its call is so much like the plaintive "pee" of the goldfinch, which it also closely resembles in appearance except when the latter is in nuptial plumage, that one unacquainted with the pine siskin might fail to notice it as a different species. The young of the year appear to show brighter yellow in their plumage than the elders, which further adds to its likeness to the goldfinch.

In August the pine siskins were observed clinging to the heads of the giant hyssop, which grew extensively along the roadsides near the Station. A small flock would thus congregate in a patch of the hyssop, feeding from the heads in the manner of goldfinches, the resemblance being increased by the bright colors of some of the young of the year and by the goldfinch-like chirps of the pine siskins. The horse mint, *Monarda fistulosa*, was also a favorite food of this species.

540 a. WESTERN VESPER SPARROW, *Poocaetes gramineus confinis* Baird.

This vesper sparrow occurs abundantly throughout the prairie regions of the Reservation. It frequents the grainfields and margins of the ranches in numbers, and is especially noticeable near the lake shore, where it visits the water's edge to refresh itself from the heat of the summer afternoons. Near the lake it appeared to be almost as numerous as Brewer's blackbird, at the time of our visit.

546 a. WESTERN GRASSHOPPER SPARROW, *Ammodramus savannarum perpallidus* (Coues.)

This sparrow was found to be common on the prairie localities of the Reservation, and several specimens were taken for identification. The males would frequently sit on a post of the rail fences and utter their queer songs, and also emit a sharp stridulating chirp or call, scarcely regarding our presence.

560 a. WESTERN CHIPPING SPARROW, *Spizella socialis arizonae* Coues.

The western chipping sparrow was found abundantly everywhere throughout our travels in the Flathead Reservation.

Everywhere we found it the same unsuspecting, social character, industriously caring for the wants of its younglings. It prefers the bushes and smaller trees for its resorts, and like the pine siskin, will frequently enter the camp in quest of morsels of food.

On August 24, the chipping sparrow was noted in flocks of twenty-five to thirty, near the borders of the ranches in the vicinity of the Station, probably preparatory to migration.

567 b. SHUFELDT'S JUNCO, *Junco hyemalis shufeldti* Coale.

This mountain form of the slate-colored junco is abundant in the vicinity of Sin-yale-a-min Lake and on Mt. McDonald to an altitude of 7,500 feet. It undoubtedly breeds in the neighborhood, as several specimens were taken while carrying food evidently for young birds. On one occasion the writer was convinced of the existence of a nest of this junco near a fallen log and adjacent brush, and searched closely for it, but was unable to discover it. The rattling ditty of the junco was heard regularly in the woods near Sin-yale-a-min Lake, a performance quite similar to that of the chipping sparrow, though uttered with more force and less rapid enunciation.

The junco is common on the wooded ridges near the Station, and undoubtedly breeds there. On June 20, a female was observed carrying food, and chirping anxiously at our presence, as if she had a nest or dependent young in the immediate neighborhood, but search for the nest was unavailing.

581 b. MOUNTAIN SONG SPARROW, *Melospiza fasciata montana* Hensh.

Common along the margins of Crow Creek. It was still in song, in accordance with its usual habit of singing throughout its entire summer residence. Several specimens were taken in the coverts near the water. The song sparrow was not noted at the foot of Flathead Lake, nor at the other lakes in the Mission Range.

The song sparrow was common in the brushy borders of the lake near the Station; also in the shrubbery along Daphnia Pond. Its melodious cadenzas were regularly heard in suitable surroundings, and specimens were frequently taken.

583. LINCOLN'S SPARROW, *Melospiza lincolnii* (Aud.)

This sparrow was not infrequently noted near the Station. A specimen was taken on July 3, from a troop of three flitting among the bushes along the road bordering the Station grounds.

584. SWAMP SPARROW, *Melospiza georgiana* (Lath.)

Though far to the westward of its regular range, a specimen was taken on August 11, in the bushes along the road bordering the Station grounds, that seemed to be no other than an undoubted swamp sparrow. It was in company with several other sparrows, apparently of the same species, but only one was secured. If the identification is correct, it will perhaps establish a record for the western range of the species.

585 c. SLATE-COLORED SPARROW, *Passerella iliaca schistacea* (Baird.)

This sparrow was found at our camp near Echo Lake, on July 12, where the loud, clear song of the males was heard in the vicinity of a small slough. Later a male yet in song was seen feeding young, and on the following morning a singing male was taken in the bushes bordering a small stream flowing through the slough. The slate-colored sparrow was not heard or seen elsewhere on our itinerary.

588. ARCTIC TOWHEE, *Pipilo maculatus arcticus* (Swains.)

Not uncommon near the Station in the shrubbery of the hillsides surrounding the ponds. It was noted regularly in the vicinity of Daphnia Pond, but was not observed generally in our collecting near the Station.

This towhee was common in the bushes of the mountainsides in the vicinity of McDonald Lake. Specimens of adults and young in first plumage were taken.

596. BLACK-HEADED GROSBEAK, *Habia melanocephala* (Swains.)

No specimens of the black-headed grosbeak were taken or noted along the shore of Sin-yale-a-min Lake, but this species appeared to be common in the vicinity of the pond southeast of the lake, and there its rich notes could be heard in the warm July afternoons. On our visits to the pond we always observed it in the higher trees, though elsewhere it manifests a preference for the smaller and dwarf trees. However, when away from the immediate vicinity of its nest, it generally rises to a higher level to enunciate its song or to glean for its insect fare. We found it still in song at McDonald Lake.

Its singing was one of the enjoyable features of the swamp woods during our June visit to the Station, and upon our return in August it still regaled us with its melody as late as the 12th. The song is almost an exact counterpart of the rich performance of the rose-breasted grosbeak, which the black-headed grosbeak also greatly resembles in habits. Several nests were found in June.

599. LAZULI BUNTING, *Passerina amoena* (Say.)

Common in the shrubbery of the bushy hillsides and ridges. It was found nesting in June. Its song is very much like that of its congener, the indigo bunting, so that a person familiar with the eastern species will readily recognize the lazuli bunting by the likeness of its musical performance to that of its relative.

607. LOUISIANA TANAGER, *Piranga ludoviciana* (Wils.)

The Louisiana tanager is one of the commonest birds of the vicinity of Sin-yale-a-min and McDonald Lakes. It was seen and heard daily in our observations, and such specimens as were needed were taken. Its chirping whistle is a familiar feature of the evergreen woods, and its brilliant livery is in noticeable contrast to the sombre regions it inhabits.

It is abundant everywhere in the woods near the Station. Its song so closely resembles that of the robin that the difference is not readily detected except when both are performing within hearing. It breeds regularly in the neighborhood, nesting in June. In August the Louisiana tanager was observed feeding on the raspberries of the fruit ranches near the Station. On August 20 we noted that the tanager was no longer observed in our daily collecting, and it is likely that it departs rather early for its southern winter-quarters.

612. CLIFF SWALLOW, *Petrochelidon lunifrons* (Say.)

This swallow was regularly noted near the creeks, where ranch buildings furnished it sites for its bottle-shaped mud homes. At the foot of Flathead Lake it was represented by a colony at Polson, and specimens were a-wing at all hours of the day, coursing over the meadows near the shore and above the haw groves in quest of the insects that swarmed the trees and ripened fruit.

613. BARN SWALLOW, *Chelidon erythrogastra* (Bodd.)

Small colonies of the barn swallow were noted at St. Ignatius, Ronan, and other settlements of the Reservation.

614. TREE SWALLOW, *Tachycineta bicolor* (Vieill.)

Small colonies of the tree swallow are found at suitable localities at Polson and near the Station. Valleys between hillsides denuded by former fires, where tall boles and bare spires are standing, are generally inhabited by this swallow, as well as the margins of ponds where naked dead trees are found. It was found nesting at the Cedar Islands, in McGovern's Bay, in cavities of the decaying cedars.

616. BANK SWALLOW, *Clivicola riparia* (Linn.)

The bank swallow was regularly noted at suitable places in our travels through the Reservation, mingling with the cliff swallow in aerial evolutions above the meadows and the water in about equal numbers. It was observed at Crow Creek and also at the foot of Flathead Lake.

This swallow breeds regularly in the vicinity of the Station, and the graceful aerial movements of the bird a-wing generally called attention to the presence of the species in the neighborhood. Specimens were regularly seen near the buildings of ranches, and near a house the only bank swallow taken, for positive identification, was shot as it flitted over the road with others in its restless pursuit of food and pleasure.

619. CEDAR WAXWING, *Ampelis cedrorum* (Vieill.)

This handsome bird, though lacking the power of song by which many of our avian friends call attention to their presence, was seen and noted in all our daily lists. Near the pond in the vicinity of Sin-yale-a-min Lake, this waxwing was very common, for above the stagnant water it found the hovering insects that furnished it a plentiful larder. Though the cedar waxwing has only the well-known lisping note with which to express all the scale of its avian emotions, it can vary its utterances of this feeble call to a considerable degree, even to such an extent that it sounds like another note.

The species was abundant in occurrence at the Crow Creek station and at the foot of Flathead Lake. At the latter place it was resorting to the haw thickets, where it feasted on the swarming insects, catching them among the branches in true warbler-like manner, and lisping its pleasure in the bounteous banquet spread for it by Mother Nature.

The cedar waxwing was found nesting in June at the Cedar Islands and in the woods adjacent to the Station grounds. At times it alights on oblique stems of low bushes, flies outward to capture passing insects, and returns to a similar station, acting greatly like a small flycatcher such as Traill's. On August 18 a cedar waxwing was taken which had the bill destroyed except the bases, as though the mandibles had been amputated while the bird was yet in the nest. The waxwing is very fond of black haw berries; it will generally swallow two or three berries, and then fly away with another in its bill. Between August 22 and 27, a medium-sized haw tree heavily laden with fruit was completely stripped by the waxwing, with the assistance of a half dozen western robins. Later in August the cedar waxwing was observed feeding on elder berries.

624. RED-EYED VIREO, *Vireo olivaceus* (Linn.)

Everywhere in our travels we noted the red-eyed vireo as quite common. Regularly we heard its emphatic monitorial song, and caught frequent glimpses of the performer as he gleaned industriously among the foliage near the branches which supported him. During our stay at Sin-yale-a-min Lake, the young vireos recently from the nest were claiming the attention of the parent birds, and upon hearing the harsh "gay" of the elder, we knew that one or more youngsters were crouched in the foliage nearby waiting for some dainty tidbit from the fond parent. This vireo breeds abundantly in the vicinity of the Station.

627. WARBLING VIREO, *Vireo gilvus* (Vieill.)

The warbling vireo was found regularly in all localities under consideration. Like the red-eyed vireo, it breeds abundantly in the Flathead region. The charming song of this vireo, which is not interrupted until the author takes its departure for its winter home, enlivened the bushy woods near the lake, and frequently regaled the ear of the collector when all other songs had been hushed by the mid-afternoon heat. It is interesting to watch this songster as it warbles forth its ditty while engaged earnestly in seeking its insect food, seldom lifting its head from its task, singing as it works.

652. YELLOW WARBLER *Dendroica aestiva* (Gmel.)

The yellow warbler was found abundantly in the haw thickets at the lower end of Flathead Lake, where its song was still heard, and its movements observed as it flashed among the branches in its active pursuit of insect fare. We also noted its common occurrence at Crow Creek, in the thickets fringing the streamside.

It is abundant in the swamp woods between Swan River and Flathead River, nesting regularly in the breeding season.

656. AUDUBON'S WARBLER, *Dendroica auduboni* (Towns.)

This handsome warbler was found to be common in the region under consideration. The clear, ringing songs of the males were regularly heard in the earlier part of the season, uttered from the middle and upper stories of the taller evergreens. It was observed on the sides of Mt. McDonald to 7,500 feet elevation.

Common everywhere near the Station in the higher woods, and nesting regularly in the earlier season. Very common in the woods in middle August, when the fall migration probably begins. In a day's collecting at Estey's Pond, August 27, the most active bird of the surrounding woodland was Audubon's warbler, and several specimens of adults and young of the year were taken by accident beyond what we needed, from difficulty in identifying them in the tall trees which they generally prefer.

668. TOWNSEND'S WARBLER, *Dendroica townsendi* (Towns.)

Whenever we entered a particular clump of small firs and bushes at Sin-yale-a-min Lake, a Townsend's warbler would appear and manifest great anxiety by chirping in nearby shrubbery. The place was searched repeatedly for evidences of nesting, but without avail. It is likely that the parent bird was feeding a youngster in the thicket, for before the end of our stay in the neighborhood the warbler had disappeared. We noted one or two other instances of the occurrence of this warbler at this camp.

Townsend's warbler was noted only occasionally in our collecting at the head of Flathead Lake. A specimen was taken August 6, on the Helena Club grounds, opposite the Station across the river, and an occasional note made thereafter regarding its presence in the woods in the neighborhood. It was generally observed in a lower story of the woodland than Audubon's warbler, frequenting about the same level as the smaller flycatchers or the yellow warbler.

680. MACGILLIVRAY'S WARBLER, *Geothlypis macgillivrayi* (Aud.)

Not uncommon near the Station, where it was found breeding in June, though only one nest was noted. Specimens were taken frequently in the woods during our August collecting. This warbler is a bird of the bushes, like the yellow-throat, but prefers bushes in low woodland to bushes near water. It was frequently noted in our lists at Sin-yale-a-min Lake; and a family just from the nest was found at McDonald Lake.

681 a. WESTERN YELLOW-THROAT, *Geothlypis trichas occidentalis* Brewst.

This yellow-throat was not uncommon in the bushes along Crow Creek, where its song was heard and specimens were taken. It was also frequently noted in the shrubbery near our camp at the foot of Flathead Lake, bordering the haw thickets.

Common in the bushes and weeds of Daphnia Pond, where it undoubtedly breeds, as it was regularly noted there both during June and August. It was also frequently observed in the bushes near the boat landing, in August.

683 a. LONG-TAILED CHAT, *Icteria virens longicauda* (Lawr.)

This western form of the chat was abundant in the bushy localities near the Jocko River at Selish. Apparently the nesting season was just beginning, June 16, as the males were in full song and persistently voluble; but though the bushes were thoroughly searched, nothing was found but structures in the first stages of erection.

685. WILSON'S WARBLER, *Sylvania pusilla* (Wils.)

This warbler, regularly making its summer home north of the United States, sometimes lingers in the Rocky Mountain regions along its northward course, and rears its brood within our borders. One note was made of its occurrence along our itinerary, where it was found nesting at McDonald Lake, June 24, 1901.

687. AMERICAN REDSTART, *Setophaga ruticilla* (Linn.)

Abundant in all suitable localities near the Station. In June it was found nesting in numbers in the swamp woods between Swan River and Flathead River. Not frequently observed in the higher woods. Its songs were heard until the middle of August.

This species occurs commonly in the trees and shrubbery along the streamsides. We found it abundant at the foot of Flathead Lake, frequenting the haw groves and willows.

701. AMERICAN DIPPER, *Cinclus mexicanus* Swains.

Along the dashing waters of the falls above Sin-yale-a-min Lake the American dipper finds a congenial home. Its dark gray attire is quite in harmony with the rocks upon which it stands in the midst of the roaring rapids, as well as the sombre light of the thick forests which surround its chosen domains. Though we searched diligently among the rocks along the falls, we were unable to find a nest. The American diper was also observed along the outlet of the lake, where the little stream dashes among the boulders on its way down the ravine. We also noted it at the outlet of Lake McDonald.

The American dipper occurs not uncommonly along Swan River, between the head of the rapids and the mouth. Very likely breeds, as it was observed both in June and August.

704. CATBIRD, *Galeoscoptes carolinensis* (Linn.)

We found several families of the catbird near our camp at Crow Creek, one nest containing three helpless young and an infertile egg. The low crooning of the catbird was frequently heard in the thickets, and occasionally the louder recitals at daybreak. At our camp near Polson we found it to be one of the common visitors to the haw thickets, and it is very probable that nests were in the adjacent shrubbery.

Regular summer residents near the Station. Nests were found on the Helena Club grounds and in the shrubbery bordering Daphnia Pond. No notes were made concerning its occurrence in August.

721 b. WESTERN HOUSE WREN, *Troglodytes aedon aztecus* Baird.

Not uncommon on bushy hillsides near the Station. It was regularly noted in June, and notes were made regarding its presence in August.

715. ROCK WREN, *Salpinctes obsoletus* (Say.)

The rock wren was regularly noted at Selish, where it inhabited the rocky mountain-side east of the Jocko River bottom. No specimen was taken.

722. WINTER WREN, *Troglodytes hiemalis* Vieill.

The dark shades of the arbor vitae forest at the head of Sinyale-a-min Lake, through which the inlet dashes in its tortuous course, is peculiarly suitable to the desires of the winter wren. There is whiles away its hours in happy content, pouring forth with astonishing persistency its little roundelay of song, and whirring from one side of the stream to the other at fancy's impulse. As in the case with the American dipper, we searched for a nest of this diminutive songster of the brookside. With equal result we tried to secure a specimen without its falling into the hurrying water. There is no doubt, however, that the winter wren is a regular summer resident at this place, rearing its young undisturbed by wandering collectors, and making melody unheard except by occasional visitors to the falls.

Noted regularly in the thick woods along the inlet and outlet of Lake McDonald. It was still in song. As at Sin-yale-a-min, we were unable to secure a specimen without destroying or losing it in the hurrying water. This diminutive hermit of the arbor vitae forest is wonderfully expert in dodging observation, whisking in and out of the observer's view with provoking restlessness, and generally perching upon branches extending over the water.

726 b. ROCKY MOUNTAIN CREEPER, *Certhia familiaris montana* Ridgw.

The Rocky Mountain creeper was not uncommon in the woods near our various camps. It occasionally visited the adjacent trees, and was generally noted in our daily lists. Specimens were frequently taken on the grounds of the Biological Station.

727 a. SLENDER-BILLED NUTHATCH, *Sitta carolinensis aculeata* (Cass.)

Common in the vicinity of the lakes and water-courses. Like the creeper, it frequently manifested its presence near our camp by its weak, penny-trumpet call.

728. RED-BREASTED NUTHATCH, *Sitta canadensis* Linn.

Quite common in the woods near the Station. On the first day of our return to the Station, a specimen of this nuthatch was taken on the Club grounds. We also noted its occurrence at Estey's Pond, and in all suitable localities included in our August collecting.

735 a. LONG-TAILED CHICKADEE, *Parus atricapillus septentrionalis* (Harris.)

Common throughout the Flathead region.

738. MOUNTAIN CHICKADEE, *Parus gambeli* Ridgw.

This handsome chickadee is doubtless a common resident of the mountainous regions in the vicinity of Flathead Lake, but it was not noted by us until Aug. 11, 1901, when a specimen was observed on MacDougal Peak, at an altitude of 6,500 feet. No other note was made regarding its occurrence.

748. GOLDEN-CROWNED KINGLET, *Regulus satrapa* Licht.

The golden-crowned kinglet was rather common in the mountainous woodlands of our itinerary, and undoubtedly breeds here, as it was noted regularly in the middle of June, always active in the tops of medium-sized evergreens and birches.

749. RUBY-CROWNED KINGLET, *Regulus calendula* (Linn.)

This diminutive inhabitant of the evergreen foliage was not uncommon in the wooded mountains. It was noted at Echo Lake, near MacDougal Peak, in the middle of July, several individuals generally associating in restless movements as they foraged among the trees fringing the water. One specimen was taken.

754. TOWNSEND'S SOLITAIRE, *Myadestes townsendii* (Aud.)

A young of the year of this species was taken on the cliff at the lower end of McDonald Lake. The female parent bird was observed at the same time, but she was not secured. No other specimens of Townsend's solitaire were noted, but its calls were often heard near our camp.

756 a. WILLOW THRUSH, *Turdus fuscescens salicicola* (Ridgw.)

One nest was found in June, in the willow swamp between the two rivers. The female was taken with the nest. No other specimens were taken, or other notes made concerning its occurrence. Later it was found to be not uncommon in the willow swamp-woods.

758 a. OLIVE-BACKED THRUSH, *Turdus ustulatus swainsonii* (Cab.)

This thrush is common in the region near Sin-yale-a-min and McDonald Lakes. It did not appear to be nesting as commonly elsewhere as at Flathead Lake, as no nests of the season were found. However, a nest was found along the trail beside Sin-yale-a-min Falls, on a horizontal branch directly above the head within reach of the hand, containing two eggs, July 11. The notes of the olive-backed thrush were regular features of the woods during our stay at Sin-yale-a-min.

Abundant in all localities near the Station, and breeding in numbers in June. Probably disappears from the neighborhood about the middle of August, as our last notes regarding its presence were made on August 9.

761 a. WESTERN ROBIN, *Merula migratoria propinqua* Ridgw.

We did not find the robin as common near Sin-yale-a-min Lake as might be fancied. With the exception of one family on the northern shore of the lake, we did not note the occurrence of this species. In this instance, the parents were feeding young still in the nest.

A nest was found on the cliff-side east of McDonald Lake in a clump of maple, with three eggs. The robin was observed visiting the water falls in the face of the cliff, to bathe and drink.

Abundant in the vicinity of the Station as a summer resident. In the second week of August, the robin was observed in small flocks of ten to twelve. During the last week of August, the robin was feeding greedily on the black haws, associating with the cedar waxwing at the plenteous banquet.

768. MOUNTAIN BLUEBIRD, *Sialia arctica* Swains.

Not common, but occasionally observed and noted in our lists.

A specimen was taken on Mt. McDonald at an elevation of 7,500 feet.

SUMMARY AND CONCLUSION

Of the one hundred twenty-eight species included in the foregoing list, it is probable that at least eight are fall migrants, breeding in the far north and entering the United States early toward the close of summer. It is likely that the remaining one hundred twenty species breed in the Flathead Lake region or near the northern border of the state. At least thirty of the birds listed are permanent residents of the region; the others are summer residents only, spending the colder months in more southern localities.

In this connection it may not be amiss to make a brief statement of facts, gathered from the preceding notes, which are considered as worthy of special emphasis. The long-tailed chat, *Icteria virens longicauda*, according to the A. O. U. Check List of North American Birds, ranges north to southern Montana; our observations continue the northward range of this chat to beyond the middle line of the state, as we found it common at Selish in the middle of June. The note relating to the occurrence of the swamp sparrow, *Melospiza georgiana*, may require revision, as the specimen passed from the hands of the collector, who was unable to obtain authoritative identification; the skin is now in the University collection, and will receive careful attention in due time. The same statement applies to the specimen labeled western gull, *Larus occidentalis*, as there is a doubt regarding its identification. If authentic, it may denote an unusual eastern range for this gull.

The abundance of the western evening grosbeak in the vicinity of the Biological Station should be remarked. From the middle of July the characteristic chirp of this grosbeak was especially noticeable, and at that time parent birds were generally observed feeding young of the year in the trees near the station. There is no doubt that this grosbeak breeds plentifully in the neighborhood, and I am of the opinion that it nests later than is generally supposed, thus causing its nesting to be frequently overlooked.

In conclusion, the writer desires to thank the Director of the University of Montana Biological Station, Prof. M. J. Elrod for the excellent facilities afforded and the opportunity of a thorough study of the summer birds of the region under consideration; also to thank the President of the University of Montana, Dr. O. J. Craig, for the neat and artistic manner in which this report is presented for public distribution.

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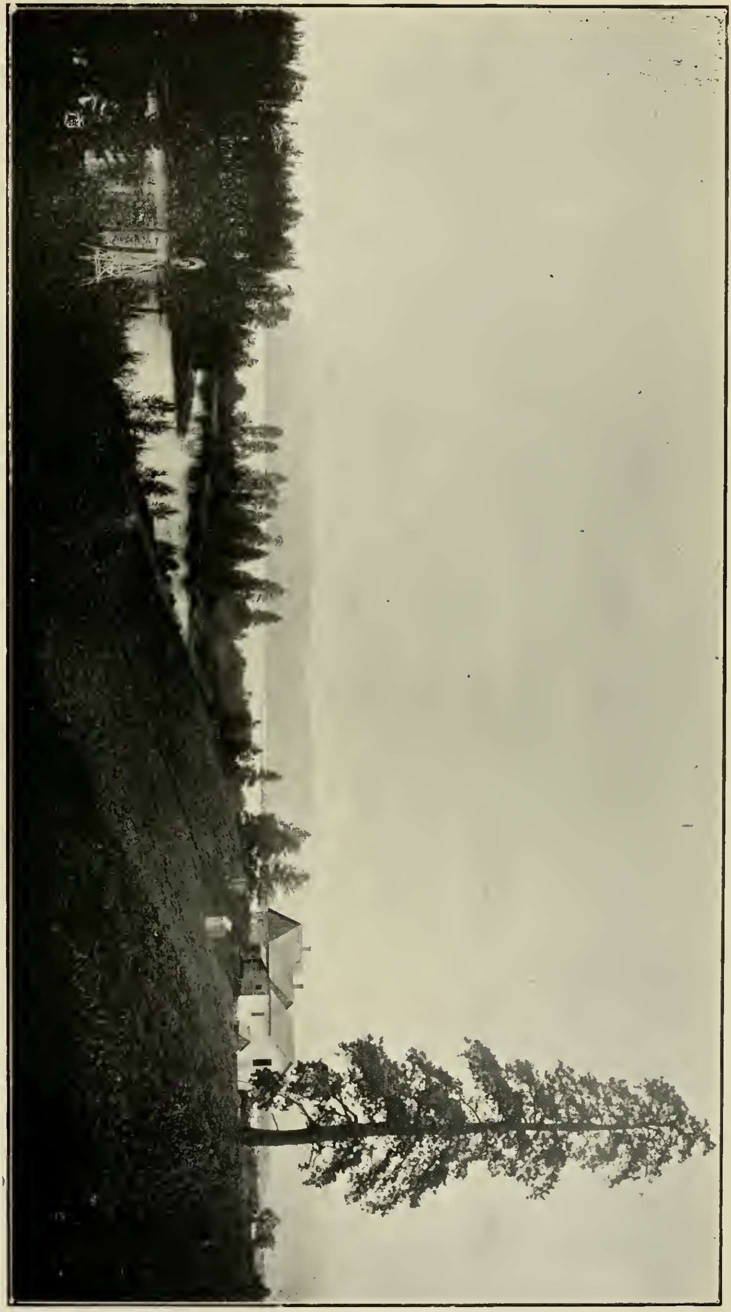
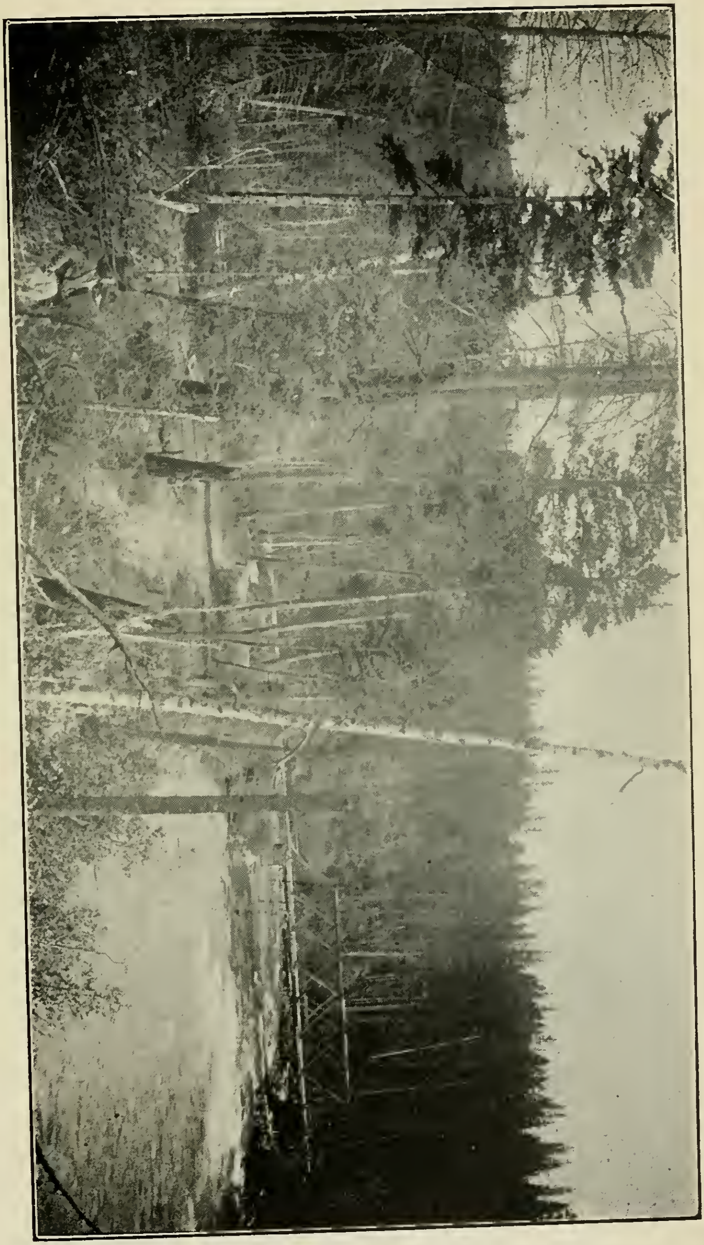
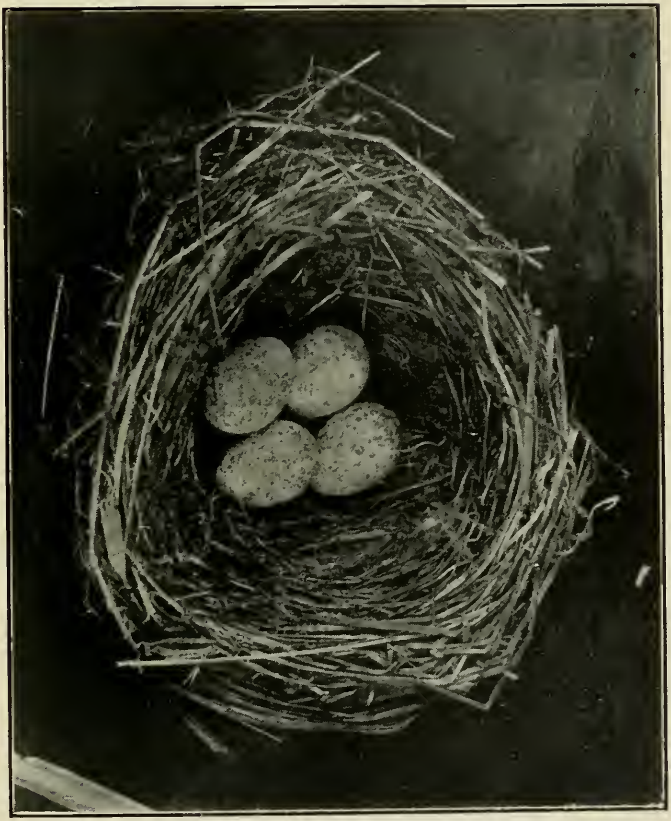


View of the Outlet of Swan River and the Upper End of Flathead Lake at the Biological Station.



Swan River, at the Biological Station, Showing characteristic Forest of the Region.



Nest and Eggs of Olive-backed Thrush.

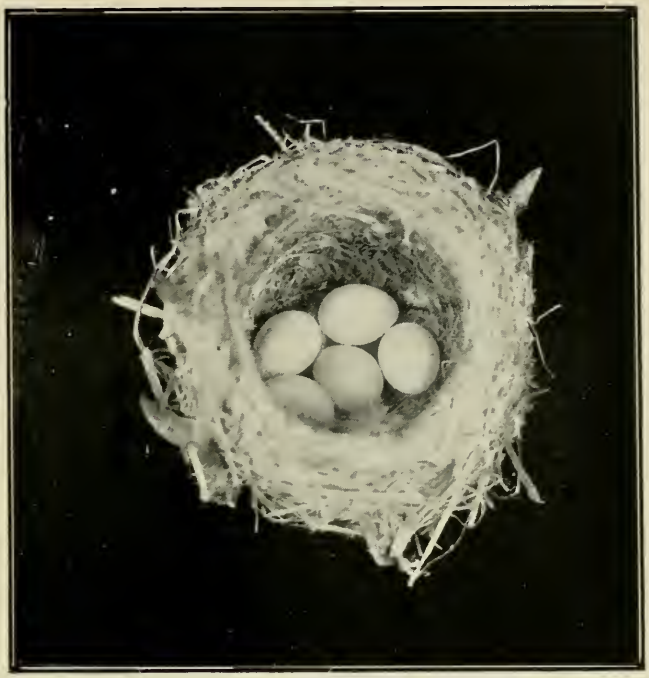
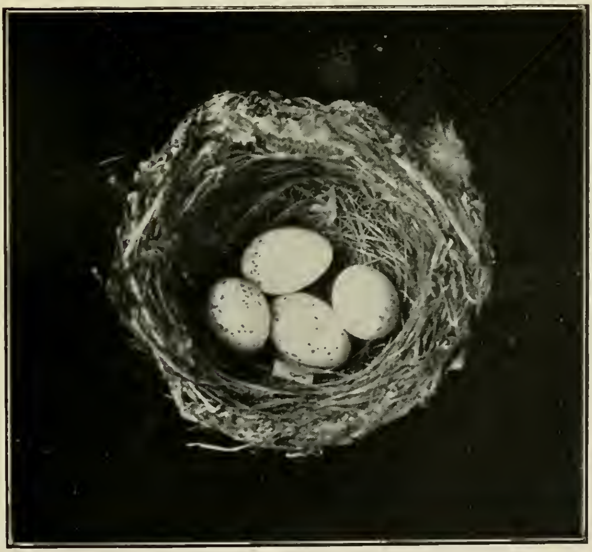
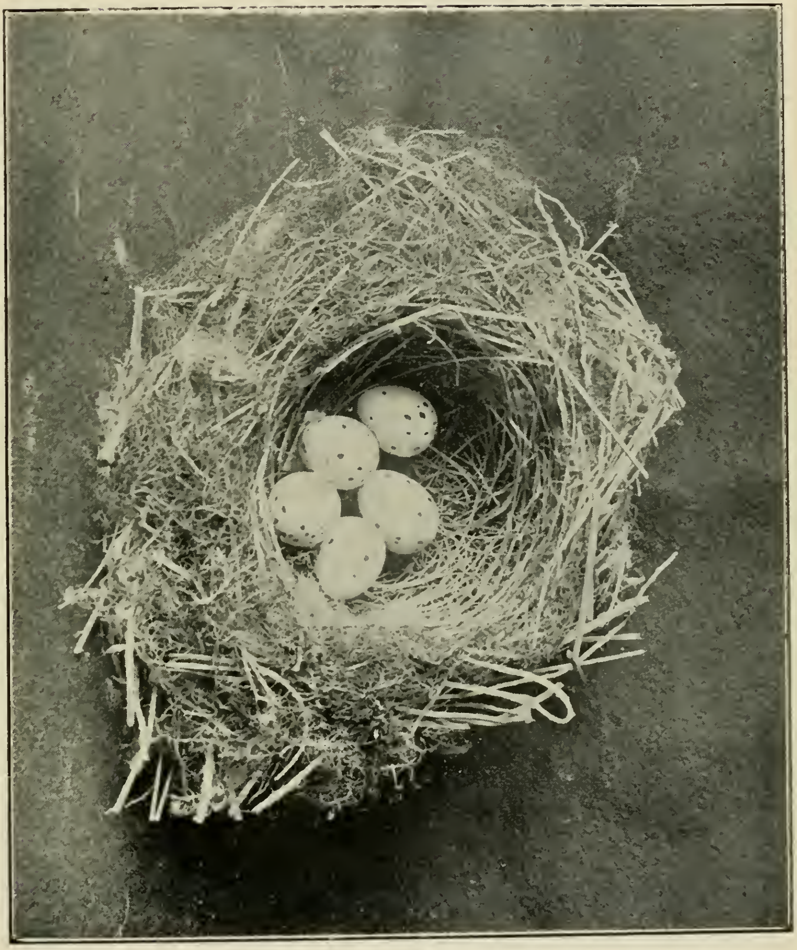
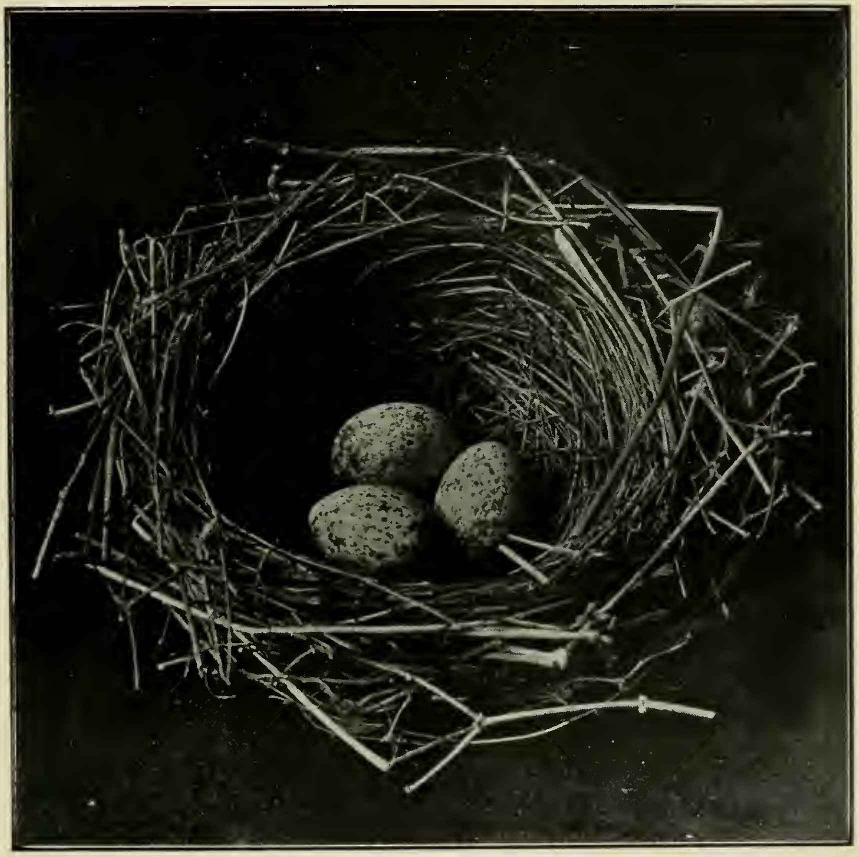


FIG. 1. Nest and Eggs of Wright's Flycatcher, *Empidonax wrightii* Baird. Compare with Plate VII and XVI.

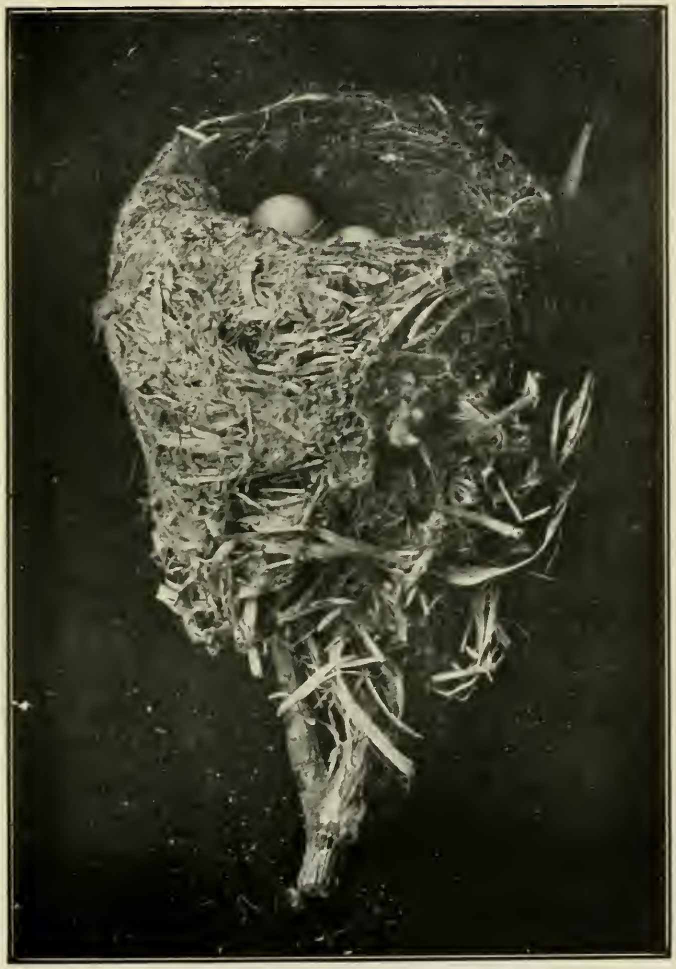




Nest and Eggs of Cedar Waxwing, *Ampelis cedrorum* Vieill.



Nest and Egg of Black-headed Grosbeak, *Habia melanocephala* Swains.



Nest and Eggs of Wright's Flycatcher, *Empidonax wrightii.* Compare with Plate IV, Fig. 1, and Plate XVI.

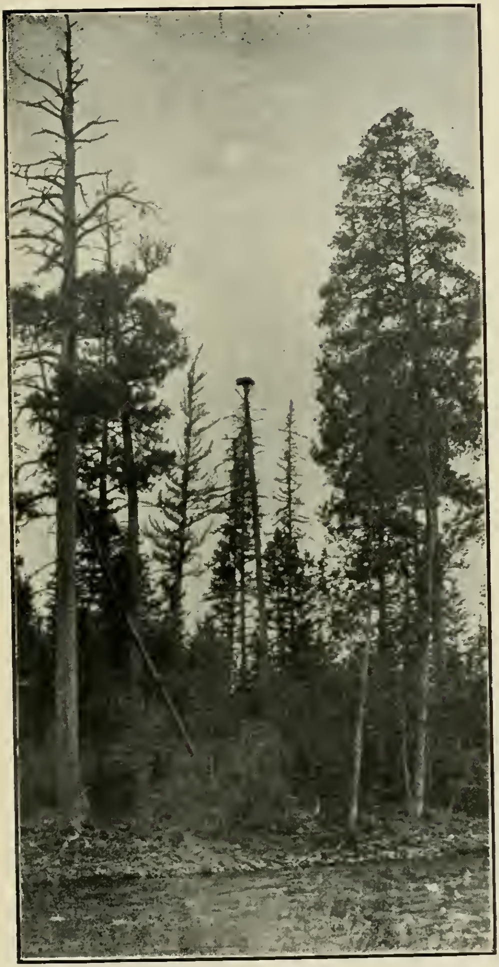


FIG. 1.

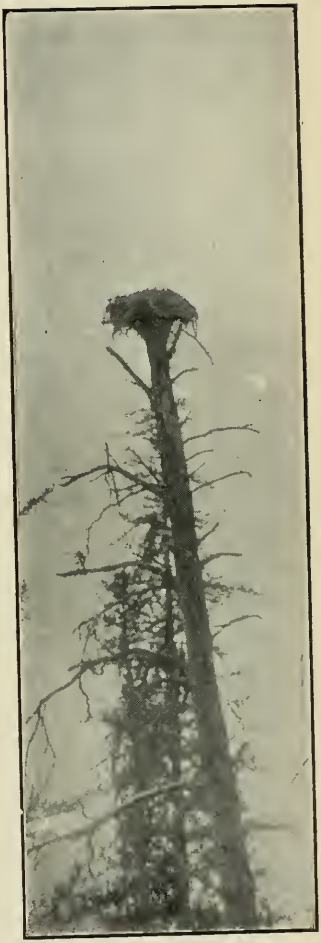
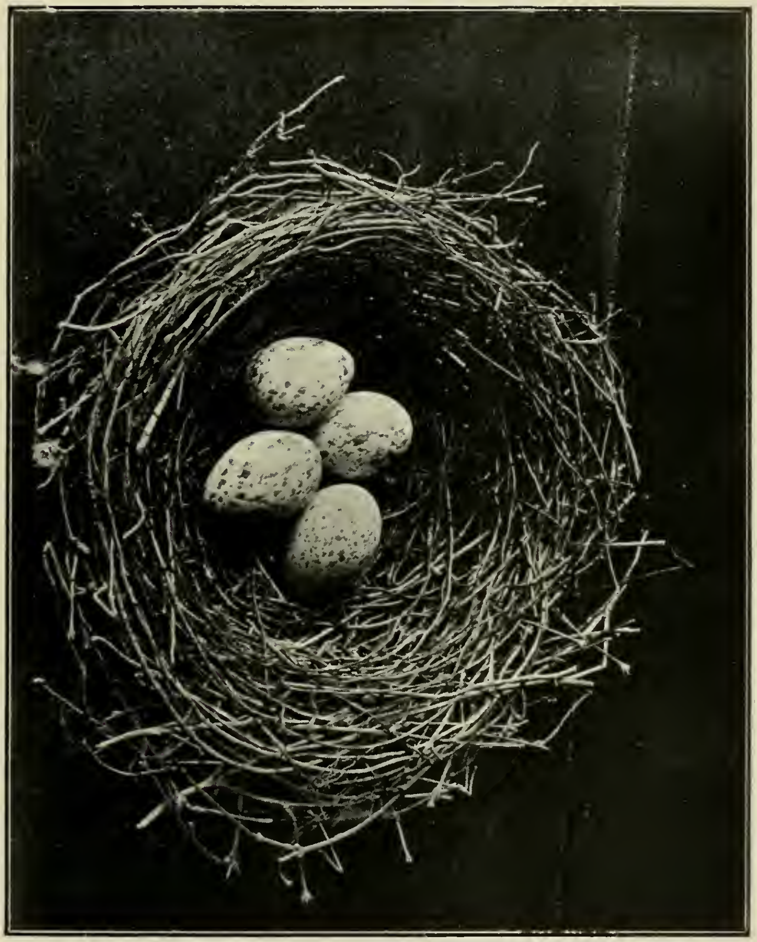


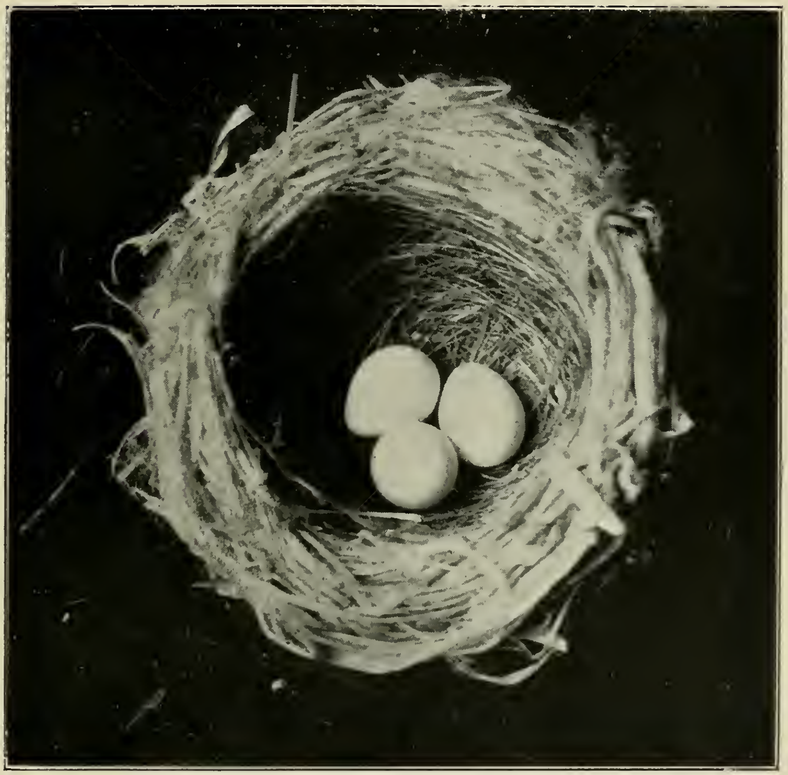
FIG. 2,

Fig. 1. Osprey Nest on the Bank of Swan River, opposite the Biological Station. Taken with wide angled Lens, orthochromatic Plate.

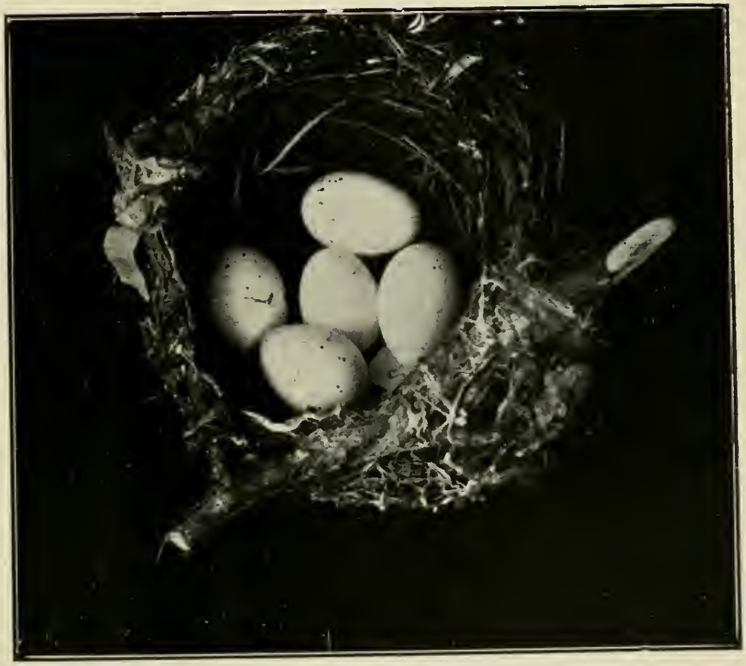
Fig. 2. Same Nest as Fig. 1, taken from the same Place and at the same Time with telephoto Lens, magnification eight Diameters.



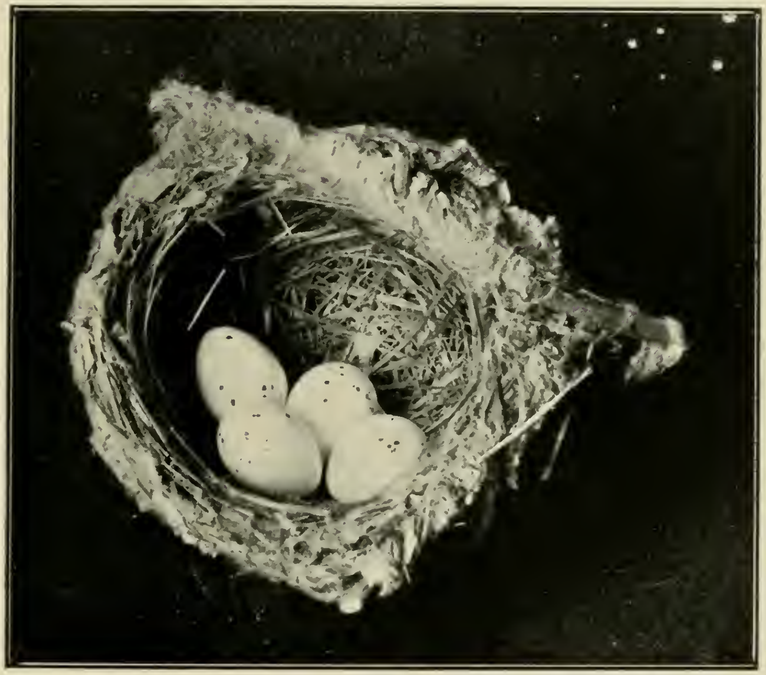
Nest and Eggs of Black-headed Grosbeak, *Habia melanocephala* Swains. Compare with Plate VI.



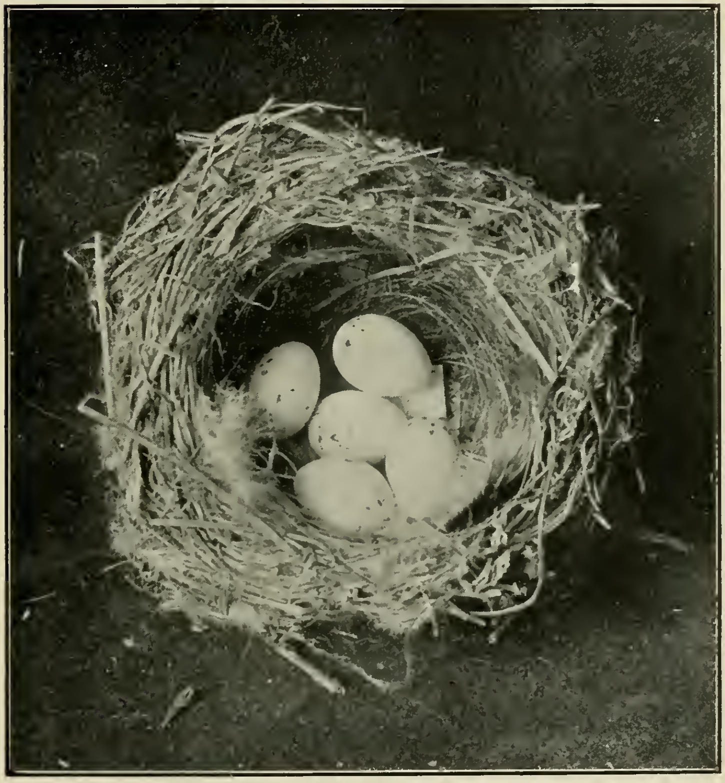
Nest and Eggs of Lazuli Bunting, *Passerina amoena* Say.



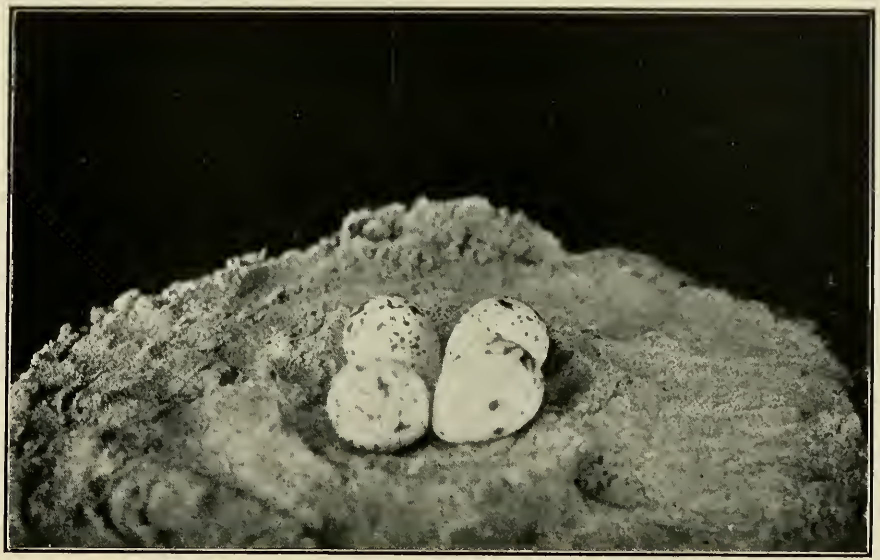
Nest and full Complement of Eggs of Red-eyed Vireo. *Vireo olivaceus* L. From Photograph with Orthochromatic Plate and Ray Filter.



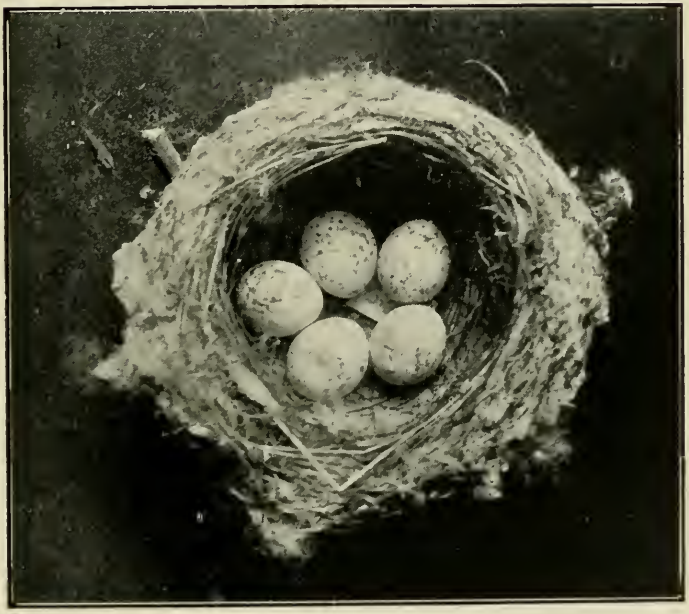
Nest and Eggs of Warbling Vireo, *Vireo gilvus* Vieill.



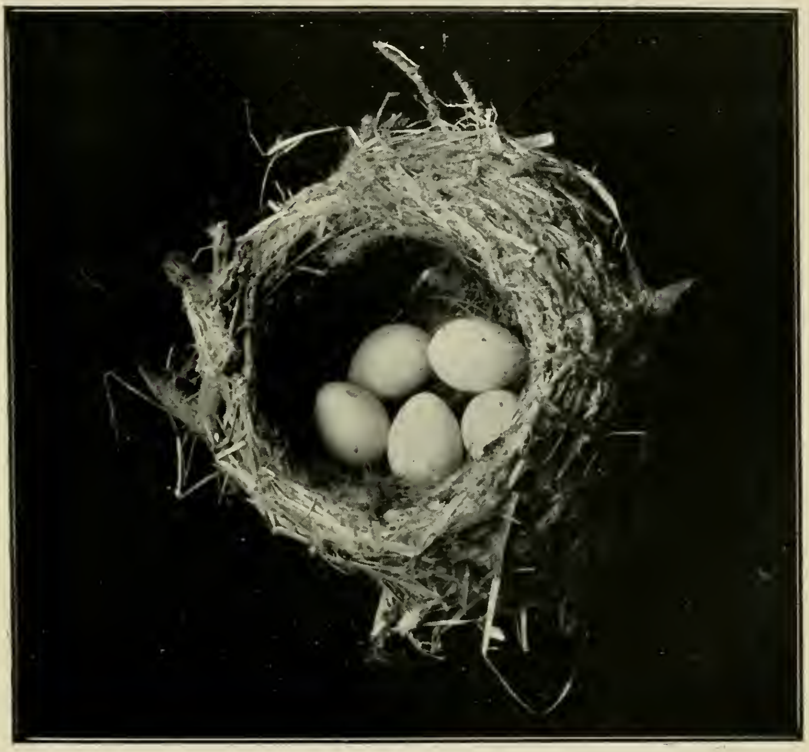
Nest and Eggs of Andubon's Warbler, *Dendroica auduboni* Towns. From Photograph made at the University of Montana Biological Station, with Orthochromatic Plate and Ray Filter.



Eggs of the Spotted Sandpiper, *Actitis macularia* Linn., in an artificial Nest of Sand, modelled after a Nest found on the Beach.



Nest and Eggs of Yellow Warbler, *Dendroica aestiva* Gmel. From Photograph made at the University of Montana Biological Station.



Wright's Flycatcher, *Empidonax wrightii*. Top View, looking into the Nest. Compare with Plate IV, Fig. 1, and Plate VII.

UNIV. OF MONT. BULLETIN No. 7. BIOLOGICAL SERIES No. 2.

FOURTH ANNUAL SESSION
University of Montana Biological Station
FLATHEAD LAKE.

BRARY
W ORK
CAL
RDEN

Postoffice, Bigfork, Flathead Co., Montana.

The laboratory work of the Station will open Monday, July 14, and continue five weeks, or until Saturday, Aug. 16.

For a week or ten days before the Station opens and for two or three weeks after the work closes some one of the Station staff will be at or near the Station, and will aid any who may choose to work during such time. The laboratory is at the disposal of students, if it is wanted, from June 15 to September 1st.

STAFF OF INSTRUCTORS.

Oscar J. Craig, President of the University.

Morton J. Elrod, Prof. of Biology, University of Montana, Director of the Station, General Zoology.

P. M. Silloway, Principal Fergus County High School, Ornithology, Elementary Botany.

Maurice Ricker, Principal Burlington, (Iowa), High School, Nature Study, Plankton.

Harry N. Whitford, Assistant in Botany, University of Chicago, Forest Ecology.

Mrs. Edith Ricker, Station Artist.

ORGANIZATION.

The Biological Station of the University of Montana was established in 1899, for the purpose of offering to the students of the University and to the teachers and students of the State an opportunity for study, collection, investigation and recreation during the summer. By providing the best facilities the state can afford, and making the instruction free to all, the summer work at the Station presents exceptional opportunities for study, and every encouragement is given to those attending to have both a pleasant and a profitable time. The situation of the Station on the largest fresh water lake in the Northwest makes possible a study of inland and cold water life not presented at any other locality.

LOCATION.

The field laboratory is located on the bank of Swan River at its outlet into Flathead Lake. This location affords a fine harbor for boats and a good camping site for the tents of those attending. The adjacent region contains forests, ponds, lakes, swamps, cultivated fields, mountains, rivers and ravines. It is rich in animal and vegetable life. The lake offers rare opportunities for collecting, and presents some beautiful scenery. East of the lake the Mission range comes abruptly to the water's edge. The range slopes from the Swan river on the north to the high peaks, ten thousand feet, at the southern end, and its scenery is wild, rugged and grand, truly Alpine in character, and rivaling the Alps in beauty and magnificence. West of the lake are the Cabinets. Near the Station Swan lake, Rost lake, Echo lake, and other waters, are easily accessible. Daphnia pond ,a few minutes walk from the Station, is rich in pond life, while Estey's pond, about as far again, is fully as productive.

EQUIPMENT.

The Station is in possession of three boats for use of students; a gasoline launch, Missoula; a 16-foot wood row boat, Culex; and a 14-foot canvas boat, Daphnia; the latter for use when it is necessary to transport a boat. The building is a convenient out-door laboratory, with tables for a dozen students. There is a dark room for photography. Microscopes, glassware, books, and utensils will be supplied from the University.

Botanical material, insect nets, pumping apparatus, and other collecting paraphernalia will be supplied.

Students in Ornithology must supply their own guns. Necessary ammunition will be supplied. Students in Photography will furnish their own cameras and plates. The necessary chemicals for development will be supplied. Students who live in tents will supply their own tents and bedding.

COURSE OF STUDY.

Zoology;

(a) Laboratory and field work, including dissection or microscopic study of type forms, with field work and instruction in collecting and preserving for laboratory use and permanent collections. Prof. Elrod.

(b) Field and laboratory course in entomology. Instruction in collecting, preserving and labelling insects. Dissection and study of type specimens. Prof. Elrod.

(c) A course in plankton methods. Collecting of microscopic organism, determination of quantity, examination of material. Prin. Ricker.

(d) Ornithology. A study of birds, with methods of collecting, making and preserving skins; habits and lives of birds of the rich avian region adjacent. Prin. Silloway.

Botany:

(a) Laboratory and field course; study of type forms. The course will consist of collecting trips in the field where common species of the different orders are found, classification of the more common species, study of structure, with methods of preservation, both dry and in liquid, for immediate and permanent use. Prin. Silloway.

(b) Forest Ecology: This course will consider the problems connected with forest botany. The work will be mainly in the field. Limited areas will be examined carefully to find out, if possible, the order of succession of different forests and to determine the relations of other plant societies to forest societies. More hasty surveys of larger areas will be made to verify and, if need be, to change the conclusions.

The following lectures, and possibly others, will be given in connection with the field work.

Factors controlling distribution of plants.

The tension zone between the prairie and the forests.

The genetic relations of plant societies in an alpine region: Mr. Whitford.

(c) Laboratory course, work to be arranged.

Photography:

No regular course will be given in this subject, but every aid which the station can give will be given those who wish to become proficient in this art. Students in photography must supply their own plates or films and paper. There is a dark room at the laboratory and the scenery in the vicinity gives ample scope for a series of negatives either in landscape or of scientific subjects.

Nature Study:

For those who may desire it a course of study and practical work will be outlined which will afford both a fund of information on which to draw during school work and at the same time secure a collection of material to be used in illustration. The scope of the work will include zoology, botany, geology, and physiography of the region. Prin. Ricker will direct the work.

METHODS OF INSTRUCTION.

The work will consist very largely of field collecting and observation, study of relation to environment supplemented by laboratory dissections and microscopic examination. The general courses will enable teachers to familiarize themselves with methods of field work, and give a store of information from which to draw in nature study subjects. The general courses also give opportunity to students and others to pursue lines of study with better facilities for out door work, with fresh material, than is generally to be had in regular university work. For this work students may receive credit on regular university and preparatory courses which are an equivalent.

Five days in the week will be devoted to laboratory and field work. The sixth will be given up to excursions. For the past three years it has been the custom at the Station to have campfire discussions. These have proven helpful and valuable, and will be continued.

The work of the Station is materially advanced by co-operation with the University of Chicago. Mr. H. N. Whitford will arrive at the Station about August first with a class, and will prosecute botanical study in the region. Students from the state may join his classes and receive all benefits therefrom.

CREDIT FOR WORK.

Students attending the station may have credit on the University of Montana books for such work as may be done, either as college or preparatory, whichever may be proper. Students in work of Mr. Whitford may have credit on the University of Chicago books on payment of tuition fee.

LECTURES.

During the session the lectures following will be given at the laboratory. They will be given daily, at least one each day. The list will probably be increased, and may be slightly modified. They are free to all students attending, and to any others who may choose to hear them.

Natural Counterfeits, Mimicry and Protective Resemblance, illustrated by water color drawings; The Life History of a Dragonfly, illustrated by specimens; The Life History of an Oak, illustrated by water color drawings; The Anatomy and Distribution of the Hydra, illustrated by specimens; The Entomostraca, their Numbers, Distribution and Utility; Some Animal Allies of Common Plants, stories of adaptation for cross fertilization, illustrated by water color drawings; Recognition of Birds in the Field; Types of Nests of Birds, with special reference to the region; Physiography of the Region Adjacent to the Station; Daphnia Pond, a Study of Environment; How to Study a Bird; Bird Songs and their Significance; Migration of Birds, causes, direction, distance, etc.; Natural History in the Graded Schools; Insects as Friends and as Foes, with practical illustrations; The Game Birds of Montana, recognition, number, habits, etc., Photography, Its Use in the Class Room and in Science; Factors controlling the Distribution of Plants; The Tension Zone between the Prairie and Forests; The Genetic Relations of Plant Societies in an Alpine Region.

EXCURSIONS.

The following excursions will be taken during the session of the Station work, unless the weather is unfavorable.

1. A trip to Swan Lake, through the forests, with stop over night at the lake. This is a beautiful lake in the mountains, of great interest biologically and geologically.
2. A trip to Rost Lake, at the base of the Kootenay Mountains. This is a lake almost filled up, a fine collecting field. It is in an admirable location for camps.
3. An ascent of MacDougal Peak via an Indian trail, to an altitude of 7,650 feet. This will afford opportunity for alpine collecting, and will present some of the most sublime scenery in the world.
4. A trip around Flathead Lake, making study of its banks, bays, and swamps.

These trips will be under the personal supervision of Director of the Station. Those taking the trips must bear a proportionate share of the expense necessary. Such will prove of great value and interest biologically aside from the pleasures they bring.

RECREATION.

Many will wish to combine an outing with study. Fishing near the laboratory is excellent. There are many boats besides those of the Station, and rowing may be indulged in. The field is excellent for photography. Bathing in the lake is always a treat and the beach is fine. The region has an abundance of fruit of all kinds. The hills and forests afford quiet retreats for study or for strolls. Few places have more natural attractions. At the proper season hunting is good. Deer have been seen a few rods from the laboratory. Grouse and pheasants abound in the hills. In season duck shooting is fine. Most of the country affords good wheeling for bicycles.

FEES AND EXPENSES.

There are no tuition fees. Students attending will be charged for material consumed, for breakage, for a share of the expense for excursions, and like necessary expense. Necessary books, chemicals, microscopes, and glassware will be supplied free. The intention is to give the best facilities possible, so as to make it worth while for students to attend.

Good board may be had convenient to the laboratory for $5.00 per week, with room extra. It is customary for most of those attending to sleep in tents, on the Station grounds, taking meals only. For those who wish to tent and cook in regular camp style there will be every opportunity given for comfort, the region affording a bountiful food supply of everything necessary, but those attending will be expected to supply their own tents and bedding.

AFTER THE SESSION.

Mr. Whitford's students will spend two weeks at the Station, after which two weeks or more will be devoted to study of mountain flora and environment, under his guidance and direction.

The Director and some of the staff will continue investigations on Flathead Lake and Echo Lake for three or four weeks after the regular work of the Station closes, using the laboratory as headquarters.

The laboratory building and grounds may be used by those who wish to carry on investigative work at all times during the season. It makes an excellent place for headquarters. Correspondence in regard to above work is invited.

DATE OF OPENING.

The course of instruction will open Monday, July 14, and continue five weeks. It will be most satisfactory to enter at the beginning, but from the nature of the work students may enter at any time.

Applications should be made as early as possible, as the accommodations are limited, and the material taken from the University will of necessity be only enough to supply those in attendance.

A collecting trip will be taken after the Station closes. It will be possible for a very small number to accompany this expedition on payment of a share of the expense. For details see "After the Session."

HOW TO REACH THE STATION.

Students via Northern Pacific will get off at Selish. Stage tri-weekly runs to Flathead Lake, (35 miles), connecting with steamer Klondike, which runs across the lake. Stage fare, one way, $3.00, round trip, $5.00, trunks extra. Boat fare across the lake, one way, $3.00, round trip, $5.00. Stage leaves Selish on Mondays, Wednesdays and Fridays, connecting with the steamer, returning the same day.

Students via Great Northern will get off at Kalispell, connecting by stage with the steamer Klondike at Demersville, a short distance from Kalispell.

OPPORTUNITIES FOR INVESTIGATION.

Any one wishing to engage in investigation of biological problems pertaining to the life of the locality, before or after the regular work, will be given the freedom of the building, boats and apparatus, and will be offered every facility possible. In such cases no fees will be charged, except for special material or reagents which may be needed.

WHO HAVE ATTENDED.

During the three years the Station has been opened the attendance has been from many states other than Montana, eight states having had representatives, representing colleges, academies, private schools, high schools, principals of public schools, students of different educational institutions, teachers of graded and country schools, and people in professional and private life. As a place where maximum work may be accomplished with minimum loss of time in a new field, under competent guidance in finding material and localities, the Station will appeal to any one interested in the work it is doing.

For further information relative to courses, routes, expenses, necessary outfit, etc., address,

MORTON J. ELROD,
Missoula, Montana.

For any information concerning the University of Montana, its departments, courses of study, etc., address,

OSCAR J. CRAIG, President,
Missoula, Montana.

BULLETIN UNIVERSITY OF MONTANA.
No. 10.
BIOLOGICAL SERIES No. 3.

A Biological Reconnoissance

IN THE VICINITY OF

FLATHEAD LAKE

BY

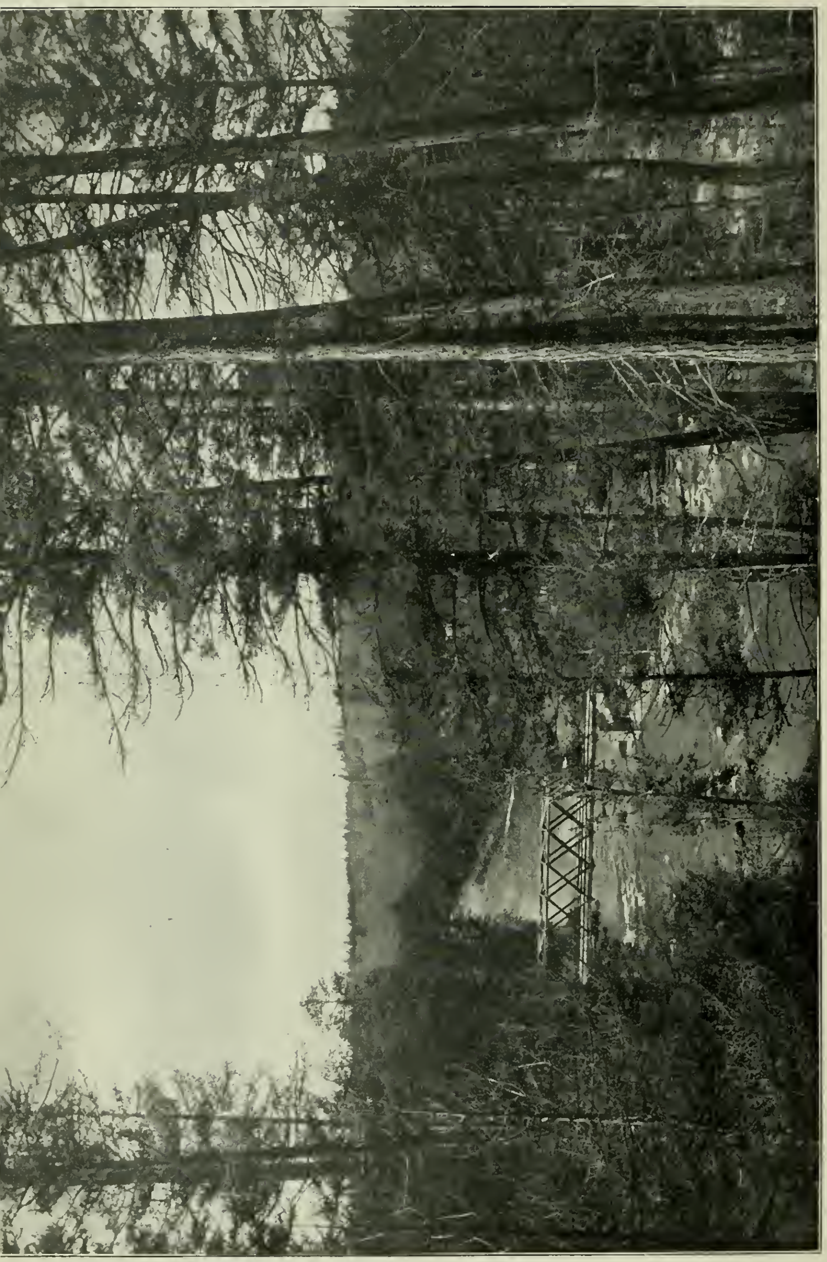
MORTON J. ELROD.

Professor of Biology, University of Montana, Director University of Montana Biological Station,
President Montana Academy of Sciences, Arts and Letters.

Prepared at the
University of Montana Biological Station,
Bigfork, Mont.

University of Montana, Missoula, Mont., U. S. A.
1902.

Plate XVII.



Site of the University of Montana Biological Station, from the bluff on Swan River. The Laboratory is on the right beyond the bridge. The river turns to the left in the distance and flows into Flathead Lake. On the left are the Helena Club grounds. The view is west.

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Introduction.

The material presented in this bulletin represents the work of four seasons in the region under discussion. The bulletin is not intended as a dissertation on a technical subject. The notes presented are given with the idea (1) of describing a region in which considerable work has been done, and in which more will be done; and (2) to indicate to future collectors in the state regions where collecting may be carried on to advantage, and some of the finds to be expected.

The material collected is being worked over as rapidly as time will permit, and in due time technical papers will be presented. Nearly 1,500 shells of the species **Pyramidula strigosa** have been gathered, from altitudes ranging from 2,300 feet to 8,900 feet. This gives an excellent series for studying variation. This work is being conducted in the laboratory at the University. A series of about 1,300 butterflies has been taken, most of which have been expanded. Many moths have also been secured. Large collections of Odonata have been secured, and as soon as the eastern part of the state is more fully covered this group of insects will be taken up, a treatise on those in the western part being now in manuscript. The botanical collections number thousands of specimens, and when the work of identification and labelling is completed the University will have a very creditable collection of the plants of the state. The collection embraces specimens from varying altitudes up to 10,000 feet, and from localities heretofore unexplored. Included among these is a large series of lichens.

A large collection of entomostraca has been made, during the several seasons, and from many bodies of water. A portion of the material has been worked over and the remainder is now being examined.

The accompanying illustrations were all taken by members of the station staff or those attending the station. Due credit is given for each. Some of the cuts have appeared elsewhere, for which acknowledgement has been made in the proper place.

The bulletin will place on permanent record much information which is important, and which in a few years would be lost or very difficult to secure.

Bulletin No. 1 of this series, "Summer Birds of Flathead Lake," by P. M. Silloway, is out of print; the large edition having been exhausted a short time after its publication.

The author takes this public manner of expressing his high appreciation of the very cordial support given by those who have accompanied him on collecting trips and assisted in the work at the Station at Flathead lake. The recollection of smoldering campfires in many wild places, with sleeping bags containing tired but happy naturalists, working without compensation for the sake of knowing, is a fond memory. It is on such occasions that enduring friendships are formed, the ties of brotherly love firmly bound, and the great and unknown field in a new country opened to view. The cheerful and happy dispositions manifested on trying occasions, when rain, or snow, or hunger, or fatigue was most severe, are characteristic of that great body of men who care neither for labor nor fatigue if there is added something to the sum total of human knowledge.

It is a pleasure to note that much of the work represented by this publication has been accomplished through funds contributed by friends. To the many who have aided in the work by contributions sincere thanks are tendered. We are under special obligation to Senator Wm. A. Clark, who has rendered great service by generous contributions on many occasions.

THE AUTHOR.

University of Montana, Missoula, Montana, September 14, 1902.

Establishment of the University of Montana Biological Station.

The organization of the University of Montana Biological Station was effected in the spring of 1899. The State of Montana contains several lakes of larger size, and many smaller ones. Very little work has been done on any of these lakes, that of Forbes on Flathead and Swan, as given later, being all that is known. Little systematic study of birds, flowers, insects, shells, or kindred topics, has been made save the collections from expeditions which have been taken to the institutions of the east for study. While there have been many expeditions to Montana and the Northwest Territory, and while large quantities of material have been taken from the state and incorporated in reports, there nevertheless has been little systematic study of particular groups by residents of the state.

Early in the spring of 1899 a trip was made to Flathead lake for the purpose of selecting a site for the station which would meet the demands for work. Through the kindness of Mr. E. L. Sliter the launch "Undine" was placed at the disposal of the writer, and almost the entire shore of the lake was examined.

The site chosen is on the main road to Kalispell, which is 18 miles distant by wagon road, and nearly double that by water. The steamboat running between Kalispell and the foot of the lake will stop to let off and take on passengers. The launch "Undine," the property of the Kalispell Club, is also moored here. It is a pleasure resort of considerable prominence. The hotel at Bigfork gives accommodations to those who do not wish to live in tents. The mouth of the river makes an excellent harbor for small boats, which is a very important item on so peculiar a body of water as Flathead lake, where the waves may rise high in a few minutes.

A small field laboratory was erected on the banks of Swan river, a short distance from the lake. A few rods from the laboratory a bridge gives communication with the opposite side of the river. Immediately above the bridge a series of rapids offers excellent sport for the fisherman, as well as exceptional field for the photographer. The country in the immediate neighborhood is well timbered. To the north the country is well tilled, fine fields of grain and good orchards making a splendid showing in the fertile valley. Two and a half miles to the west the Flathead river enters the lake, its mouth being marked by a well defined delta with sand banks and shoals, a great shelter for birds during the migrating season.

The laboratory is a wooden structure with suitable accommodations for summer outdoor work. There is table room for twelve students. The site is excellent for camping. A large spring enters the river from the bank immediately below the laboratory.

A mile and a half from the laboratory along the road south is Daphnia pond, covering some fifteen or twenty acres. A description of this pond is given later. About the same distance farther is Estey's pond, covering a little less space, but fully as interesting. It is eight miles by the nearest road to Swan lake. This lake is the expansion of Swan river, and lies in the glaciated valley between the Swan and Mission ranges. The lake is about 12 miles long, perhaps a half mile to a mile wide. A few miles to the northeast is Echo lake. Near it is Rost lake. Along the banks of Flathead lake on either side may be found numerous ponds and small lakes; others are reported to be in existence, but have not yet been studied or examined. The northern part of the state is well dotted with lakes which await study.

The Lewis and Clarke Forest Reserve extends to within a few miles of the station, and offers exceptional opportunities to study forest influences and subjects relating to forestry.

A few miles eastward and the Swan range of the Kootenais is reached. This range has several peaks nearly 10,000 feet in hight, with dozens of alpine lakes, rock ridges, snow slopes, and other collecting places. The Mission range is immediately south of the station, ending as a range at Swan river. The range makes the eastern bank of Flathead lake, is well timbered, and rises higher toward the southern end, where the peaks reach nearly 10,000 feet.

The preliminary work of the Station naturally falls within the country immediately near the laboratory, and in the Mission mountains and the Mission valley. This territory lies between Missoula, where the University is located, and the laboratory. In the fall of 1897 a collecting trip of three weeks was taken to the Flathead Reservation. This was the first collecting expedition from the University, and resulted in a large supply of material in various lines.

In 1899, during the month of August, the first work of the Station was begun. During this month considerable time was spent on the lake, making soundings and gathering microscopic forms from the water. These are incorporated in a paper presented to the American Microscopical Society.

In 1900 two months were devoted to the work of the Station. The month of July was spent in the Mission mountains and in the Mission valley gathering material, the month of August being spent at the Station.

In 1901 a party outfitted at Missoula, and started for the field June 13, continuing the work of collecting and studying either in the field or at the laboratory until August 21, when the party returned to Missoula.

The party consisted of Dr. D. T. MacDougal, of the New York Botanical Garden, making collections in botany; Wilson P. Harris, of Brooklyn, N. Y., collecting lichens; Maurice Ricker, Burlington, Iowa, High School, collecting entomostraca; P. M. Silloway, Fergus County, Mont., High School, studying birds, and the writer.

Collections were made in the Mission mountains. Several peaks were ascended, and McDonald and Sinyaleamin lakes, which had been visited the previous year, were again visited for comparison of records. The party moved slowly up the east side of Flathead Lake, making occasional excursions into the Mission range.

After reaching the station and depositing a large proportion of the luggage a trip was taken to the foot of the Swan Range eastward. Rost lake and Echo lake were partially studied. Several excursions were made into the range, with packs on backs, and many peaks ascended.

In August, Dr. H. C. Cowles, from the University of Chicago, with a party of nineteen students, spent ten days at the laboratory. The entire party, with many others, made the ascent of the Swan range in safety, returning laden with specimens. More detailed information relative to these mountains and their lakes is given later.

During the summers of 1900 and 1901, Prin. P. M. Silloway, of the Fergus County High School, spent the months of June, July, and August in the study of the birds. The nesting birds near the laboratory were made a special study, and a good series of nests and eggs secured, notwithstanding the weather was very bad most of the time. The results of the work are embodied in the bulletin from the Station (21). He also made extensive studies of the birds in the Mission range and in the Mission valley on the west of the range. During this time a large series of skins was secured, now deposited in the museum of the University, and a large amount of data collected relative to the birds of the state. This gave excellent opportunity for studying those birds which make the state their summer residence. As a matter of fact there were less than a half dozen birds noted which apparently came from the north on their autumnal migration.

L. A. Youtz, of Columbia, devoted two months of the summer of 1900 exclusively to the study of the entomostraca of the lakes and rivers in the western part of the state, so far as the travels during the summer permitted. His observations extend to the waters of Sinyaleamin lake, McDonald lake, the ponds and creeks in the Mission valley, Flathead lake from one end to the other, Flathead river, Swan river, Daphnia and Estey's ponds, and to this was added the material from Swan lake after he left the party.

During the following summer the work was continued by the writer, assisted by Maurice Ricker, of the Burlington, Iowa, High School. The same lakes and rivers were visited, as also Echo lake, Rost lake, Silloway lake, Placid lake, Trail lake, and other smaller bodies and streams of water.

In 1902 work at the Station was continued during July and August. Mr. Harry N. Whitford, with a party of botanists from the University of Chicago, carried on studies in forestry. Large collections of plants were made, forestry conditions carefully considered, and a large series of photographic negatives made. Prin. P. M. Silloway spent the month of June at Swan lake, and July at the Station. He secured much information additional to that given in his bulletin "Summer Birds of Flathead Lake," which will be incorporated in a supplementary report. The work of collecting entomostraca from the lake was continued by Mr. Maurice Ricker, of Burlington, Iowa, and the writer.

Special Studies.

Among the other groups special study was made on shells and dragonflies. Shells in the State of Montana are relatively scarce. Few reports have been made on shells taken from this region. The only list so far available is the one given in Nautilus, Vol. VIII, p. 63, giving a list of 42 species from the Missouri river. The material from the western side of the range lists 21 species. The conditions in the State of Montana are not favorable to the growth of shells. The rivers are rapid, with scarcity of food, and with little lime. The lakes contain clear cold water, are usually deep, with few swampy places, and with rocky shores and bottoms. The marshy stagnant portions of the lakes are usually small, and liable to dry up in summer. The mountain sides in summer become dry and parched, except in protected portions and along streams. Great stretches of plain are without moisture for a portion of the year, and almost every living thing that cannot move to the water courses is killed. The days in summer are hot, the nights cool. The air is dry and evaporation is rapid. As a result of the above conditions we may expect great variation of species in adjacent regions, where the barriers may be sufficient to cut off all communication between the regions. It is hoped by making extensive collections of land and fresh water shells to secure sufficient material to throw some light on the geology of the region, which now offers many difficult and complex questions. One new species has been discovered, and the first living specimens secured. Another has been found at an altitude of 9,000 feet. In the report of the work on the lakes following information is given regarding the limited number of species found in each.

The work on Odonata has been prosecuted with more or less vigor during the past four years, besides material taken at different portions previous to that time. The result is the discovery of about fifty species in the state, which is not a large showing. The same conditions making it difficult for shells to grow in the waters of the state will apply to dragonflies. The young live in water, which must not be swift nor too clear, but must offer sufficient animal food to keep the larvae alive, must be stagnant enough to support life of such slow and uncouth water dwellers and must offer them suitable hiding places to keep out of the sight and reach of enemies. Such places are not common. In Illinois the writer was accustomed to visiting the ponds around town, taking as many as 25 species in a single afternoon. In Montana a hard and long day's work has resulted in but six species, and not many specimens of these. From this it will be seen that dragonfly collecting in the state is not only difficult, and the results meager in amount of material, but from what has been said there is a possibility of securing many new and interesting things.

During the three seasons of collecting in the western part of the state large numbers of botanical specimens have been secured, which are deposited in the herbarium of the University, and await study.

It will now be helpful to the reader to give some information concerning the region under discussion, which will convey a better idea of the country than has heretofore been given.

The Mission Mountains.

The Mission range is familiar to all old-timers of the State of Montana. Its snow-clad peaks appear suddenly before the eye as the traveler reaches the crest of the hill above Selish, the railroad station on the Northern Pacific where the traveler leaves the train and takes the stage for the mountains, Flathead lake, or Kalispell. The first view is one of grand comparisons, with the broad and beautiful valley in the foreground, the majestic peaks of the Mission range behind; while in the direction opposite rise the rugged Cabinets, the abrupt and pointed Squaw peak being the most conspicuous.

No one can see the Mission range without bursting into exclamations of surprise and admiration. A view is given in Plate XIX. The high, snow-capped, jagged peaks, rising abruptly from the valley, usually shadowed by clouds whose lower strata obscure the higher peaks, offer such decided contrast to the level valley that the comparison is very noticeable.

The range is about 75 miles long, the higher peaks being on the southern end. The range slopes gradually down to a lower altitude northward, finally ending as a range at the Swan or Bigfork river.

Very few of the peaks in the range have received names, though most of them are large enough and of sufficient importance to be named. McDonald peak is the only one with a name recognized as belonging to a definite height. McLeod peak is a well established peak on the southern end of the range, and has been one of the points used in triangulation by the United States Geological Survey for many years. McLeod peak is south of the Jocko river. Big peak is another name given to one of the heights opposite the peninsula at Flathead lake. But the particular height to which the name is applicable is not definitely established. Aside from these three, and a fourth on the map a little north of McDonald and called Teton, none of the peaks in the range have names. Since the work in this region was undertaken the necessity for naming many of the peaks, lakes, and points of interest has become apparent, and some suggestions have been made.

Mention was made of the fact that the Mission range was cut in twain by the Jocko river. Immediately north of the river is a high point, very conspicuous, and without a name. The name suggested for this is Sinyaleamin, an Indian name meaning "surrounded." Years ago the Flathead and Blackfeet Indians had a fight on the banks of the creek having its source in this mountain, with the result that the Blackfeet were surrounded and exterminated. The Indians made reference to this in naming the creek "Sinyaleamin," afterwards changed to Mission. As the mountain mentioned had up to this time no name the name Sinyaleamin has been given to it. Plate XX gives a view of this mountain. It is also seen on the right in Plate XIX. East of Sinyaleamin, and apparently a part of the same range, are the well known Jocko peaks, shown in the illustration from the mountain summit, Plate XXI.

The range extends almost due north and south, the meridian 37 passing along the western base of the range. The 46th and 47 parallel degrees approximately mark the southern and northern ends, though a large bend extends toward the east in the southern end of the range.

The drainage from the western side is across the Flathead Reservation, through several creeks, into the Pend d'Oreille river, and into Clarke's Fork of the Columbia. The drainage from the eastern side is into the Swan river, north around the range into Flathead lake, and out through the Pend d'Oreille river as before. From the southern end the waters are carried by the Jocko river into the Pend d'Oreille river. A portion of the eastern slope of Sinyaleamin mountain, as also the eastern slopes of the Jocko peaks, drains into the Clearwater river, thence into the Big Blackfoot; from this into the Missoula, and finally into Clarke's Fork of the Columbia. It is thus seen that the entire drainage of the range is into the same stream, though by very different routes, and over distances of varying lengths.

SINYALEAMIN LAKE.

The first place in the range at which work of consequence was undertaken was at Sinyaleamin lake. See plates XXII and XXIII. As has been stated, this little alpine lake is at the southern base of Sinyaleamin mountain. From the nature of the location of the lake the name is very appropriate. Locally the lake is called St. Mary lake. As there is another larger and more widely known St. Mary lake in the northern part of the state in the Blackfeet reservation, the name Sinyaleamin lake is most appropriate for this beautiful little sheet of water, and should be retained.

St. Ignatius is about six miles from Selish, on the Northern Pacific railroad. From St. Ignatius to Sinyaleamin lake the distance is given as nine miles. The distance to the mouth of the canyon is nearly six miles and the road up the winding canyon is about three miles. The road across the valley is excellent. A mountain road has been constructed up the canyon to the lake. This is passable in summer, is no doubt good in winter, and with a little work could be made very good indeed, save for a couple of steep hills. The road follows up the canyon carrying the waters from Sinyaleamin lake. This stream joins the main stream before it reaches the Mission. The waters from the branch stream are derived almost wholly from Sinyaleamin lake. The waters from the main stream of the Mission creek come from the mountain peaks to the north of Sinyaleamin mountain, tumbling over a high fall which may be seen miles away on the plain.

The lake is hemmed in on all sides by mountains, only a small flat near the water affording a camping site. This camping site is on the top of an old moraine which is well covered with small timber. If the timber was cleared away there would be a good-sized camping site in an admirable location for scenery. Campers are continually widening the small space by cutting down small trees for fuel and it is now a delightful place for a camp for either outing or study.

Our camp at this lake was from July 7 to July 18, 1900. The party numbered 15 most of the time, and for a couple of days there were 23, including a number of distinguished visitors. The weather was perfect, not a thing to stop work for the entire time.

A second visit was made in June, 1901, a month earlier than in the preceding year. A large collection of plants was made and further notes and collections of shells were taken. Dredgings were made for Entomostraca in the lake and in the ponds to the south of the lake. As the season was early there was much moisture. This made the material collections more abundant but made the work more laborious.

On the north side of the lake the mountain rises abruptly to a height recorded by our aneroid as 9,200 feet, probably 200 in excess of the true height. On the summit abundance of snow could be seen. The lower slopes are moderately wooded with small red fir, while the upper heights are bare jagged rocks. On these a few white-bark pine have a foothold. See Plate XXIV. On the east and south of the lake the summits are lower, sloping gradually to the south and then to the west where the ridge descends almost to the level of the waters of the lake. The mountain sides in this direction are densely wooded with small trees. The western end of the lake is the only part with what might be termed open country. Here the lake is dammed by a moraine which is now covered with small trees and other vegetation. This moraine extends across the ravine, which is here about a quarter of a mile in width, and down stream for nearly a mile, as nearly as could be determined. The present outlet is at the southern end of the moraine. There are indications that the outlet was formerly at the other end of the moraine, next the mountain side proper. From indications it would appear that the lake was formerly larger than at present, when the waters were dammed up, overflowing what is now the good camping place, and for some distance beyond. On the moraine the vegetation is different from that at other places, indicating that the period when the waters covered this part of the moraine is not so very far back in time. The time that has elapsed since the outbreak at the present outlet has not been great. When the lake occupied this addition it was larger, and perhaps forty or fifty feet deeper. When the water first started at the present outlet the cutting was rapid, as shown by the abrupt and narrow declivity at the outlet, and resulted in the present lake level.

By damming up the present outlet the level of the lake could be raised about fifty feet without overflowing the moraine.

The lake is about 7,500 feet long and 2,500 feet wide. The shape and outline are readily seen from the accompanying sketch. See Fig 1. The length lies east and west. The lake is clear, cold, and deep. At 8 P.M., July 9, 1900, the temperature was 15 degrees Centrigrade. By trials it was found that the white net used for collecting entomostraca could just be seen at a depth of 30 feet. The dark rocks on the bottom could be seen only at much less depth than this.

The banks of the lake are precipitous, no shoals or rocks being found. The largest shallow place is on the western end of the southern side where a small shallow place some 300 feet long by 50 feet wide slopes

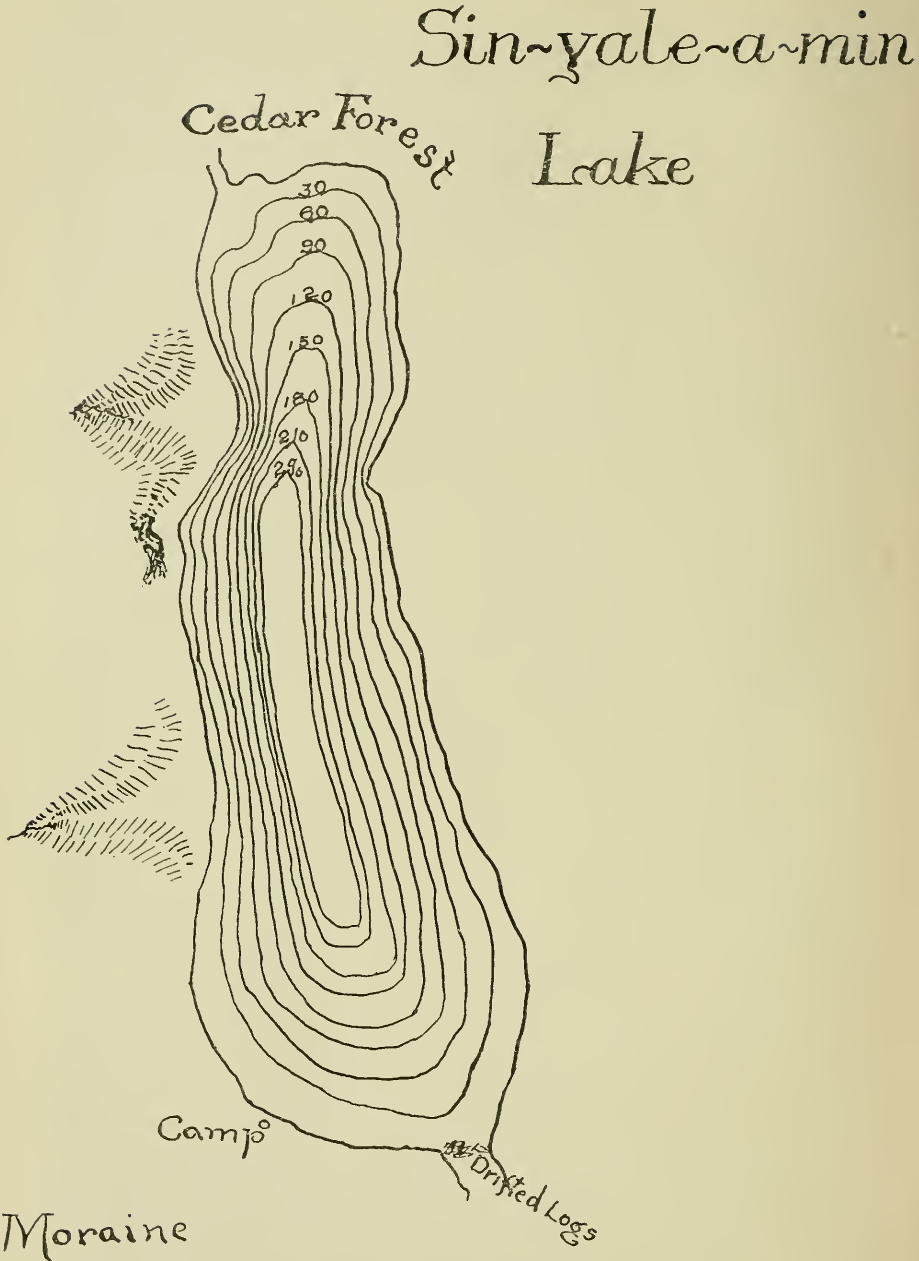
Sin-yale-a-min
Lake
Cedar Forest
30
60
90
120
150
180
210
240
Camp
Drifted Logs
Moraine

Fig. 1. Diagram, showing shape of Sinyaleamin Lake.

down from shore. At the upper end, around the inlet, there has been some filling, but it has been slow. The depth a few hundred feet from the inlet was 30 feet, but it shot down rapidly to 115 feet, and finally to 250 feet, the deepest recorded. This depth was taken opposite the rocky cliff toward the upper end, but a glance at the map of the lake will show it is everywhere deep. But a few feet off shore near camp at the southern end the depth taken was 165 feet.

There is but one inlet, at the upper end, draining the eastern slopes of Sinyaleamin mountain and the Jocko peaks where there is abundance of snow the year through. There are no small inlets save when the snow is melting off the hills in the spring, but there must be a little underground seepage, as there is considerable water on the mountain sides high up that disappears before the stream reaches the lake.

The stream forming the inlet comes through a canyon from the north, Sinyaleamin mountain forming the western wall, one of the Jocko peaks the eastern. Along this creek for a quarter of a mile or so there is a rank growth of beautiful arbor-vitae trees, as shown in the illustration. See Plate XXV. These continue until the canyon becomes so narrow there is room only for the stream, which tumbles over a cascade several hundred feet high, a portion of which is shown in Plate XXVI. This cascade was followed for some distance and as far as could be seen or heard the cascade continued. Later, from the summit of the mountain, the direction and source of the stream was determined.

On account of the land locked position of the lake it is seldom disturbed by storms, although some strong gusts blow in from the west. The surface is usually calm and smooth, timber growing to the water's edge, making a beautiful reflection. It appeared from indications along the shore that the surface of the water in the lake varied some three or four feet, at the time of our visit being at its lowest. There is very little drift in the lake. At the outlet there is quite a pile of old logs that have come down, but they show evidences of long submergence in the water, and are not in great quantity considering the timber around the lake. The shores are free from drift.

Three ridges lead up from the base to the summit of the mountain, all of comparatively easy ascent. The ascent of the mountain from the lake, whose altitude is 3,800 feet, was made in a day, returning very late at night. We almost failed making it though within sight and hearing of the camp. This summit is really a long ridge, extending southeast and northwest, culminating in two peaks, and joined to the remainder of the range to the north by a low spur at the easternmost of the two peaks. On the north the drainage is into the main branch of Mission creek. The western peak drains into the stream below Sinyaleamin lake. The drainage from the country to the eastward and southward, as shown in the illustration, see Plate XXIII, is into Sinyaleamin lake.

On the 12th of July, 1900, the ascent of Sinyaleamin mountain was made. The start was made before seven in the morning, three of us preparing our loads for the ascent. The outfit consisted of a camera with 15 plates loaded, a rifle, a shotgun, a botany can, provisions for a day, and necessary ammunition and material for saving specimens. Although it was the middle of July the morning was quite cool. By keeping behind the hill on the western ridge of the three we were in shadow for a good portion of the distance. It was not until nearly at the limit of trees that the sun's rays began to be felt. The ascent to the timber line was devoid of interest, save that at about 7,000 feet a mother bird with a brood of chicks about three days old was flushed among the Xerophyllum through which the ascent led. This grouse, known as Richardson's grouse, seems to be common to this range of mountains, and was taken on several different occasions. It was a surprise to find the chicks so young. This proves either that the bird had misfortune the first sitting and made a second nest, or that the altitude retarded the nesting time. The size of the birds discovered and their ability to escape at the age of a few days may easily be conjectured. Two of these little fellows were captured by hand, and proved to be the only birds secured on the trip.

Lunch was eaten at 7,800 feet, and the summit looked near, but the ridge looked steep and rocky. We were ascending a "hog back," a ridge leading to the summit. It was narrow, in places no more than wide enough to travel in single file, occasionally widening with small grassy plots, in which flowers were growing in great profusion. On the summit of the ridge, and occasionally in the crevices on the sides, a few white-bark pines had a foothold. See Plate XXIV. Their trunks were gnarled and twisted, with broken limbs and stunted branches, showing plainly the great struggle they were enduring. The dead trees are light and dry, burning with a great amount of smoke and much pitch, blackening everything used about the fire for cooking to an unusual degree. The picture given shows plainly the condition of the trees.

Insects are always scarce in high altitudes and flowers are always brilliant. The slopes of Sinyaleamin mountain were no exception. The zoologist may find some food for reflection in this. If insects have been instrumental in developing color in flowers, as is concluded from modern theories, this condition is to be expected. The few insects seen were very busy, and had a wide field to work over and an abundance of flowers to select from.

Luncheon over, and a supply of typical flowers having been gathered and a few insects taken, the ascent was resumed.

Mountain climbing to some people is a pleasure, to others a drudgery. Certain it is that few people enjoy climbing up among the timber and over slippery grass, with nothing to see but the limbs of trees immediately ahead, the grass or rocks under foot, and occasionally a patch of blue sky or a glimpse of a peak or a canyon. But when one finally ascends to the rocks, where grass does not grow, where trees are few and stunted, and where solid rocks are piled in stratified layers or tumbled in confusion as the case may be, mountain climbing becomes to most people a pleasure and a reality. When one can rest on solid rock for a moment and before him see the peak in all its grandeur, to the right a mass of snow with a stream of silver leading away, to the left a wall of rock 3,000 feet high, it is worth the effort needed to get to the position.

The interesting part of this climb was that one of the party was being initiated, never having climbed before to such a height or been in such a trying place. The result was interesting both to himself and the others. The sight was too much, and his nerves refused to stay under control. All his will power was not sufficient to hold his muscles in control, and he shook as with a palsy. Places that could be passed with a step were trying and difficult, and often required minutes to get over. He reported it seemed as though all the rocks were loose and ready to tumble down, and to see him pick and try at rocks to see if they were stable was under most circumstances really amusing. Under present conditions it was trying. Needless to say the rocks were solid. It is sufficient to say that in such attempts either all reach the summit together, or all return together without reaching it. The higher we ascended on the peak the sharper the ridge became, and the steeper, and with this there was greater trepidation on the part of the shaking member of our party. Constant encouragement was necessary, and repeated lifts and boosts were given. Although a man of mature years and of careful habits, ordinarily calm and deliberate, he reached a point where he had no confidence in himself, and even refused to stand erect on places that were perfectly safe and with abundant room. All this was the result of the effect of the crags, cliffs, waterfalls, and peaks on such an immense scale that it was too much for the nervous makeup to stand, and there was a collapse. When the collapse came it was quite complete, and lasted until the foot of the mountain and camp were reached. Needless to say the result was to make the individual exceedingly weary. Long before the others were tired he was almost overcome, though this was most noticeable after the last cliff and crag were out of sight behind.

The last thousand feet of rocks were almost completely bare. But at the altitude of about 8,500 feet, as indicated by the aneroid, we came across a small shell among the rocks, on the summit of the ridge. This little shell belongs to the Pyramidula, and is known as **P. strigosa** var. **alpina**, and was found in considerable abundance. While the others went on the conchologist devoted a quarter of an hour to the search, resulting in securing some two or three dozen and several live ones. No doubt many could have been found if search had been made, as they were picked up occasionally almost to the summit. There was very little vegetation on which these shells could live, an occasional plant with a few leaves and a stunted stem being seen here and there on the rocks. Aside from this there was nothing to decay. The trees had long since been left behind and there was nothing else alive visible, save the lichens.

These shells reveal a very interesting point in adaptation. A near relative has been found on the high mountains in various portions of the State of Montana. **Pyramidula strigosa** Gld., small variety, has been taken on the sides of nearly all the high mountains in the western part of the state. They have been collected at an altitude of from 8,000 to 9,000 feet in the Tobacco Root mountains in the eastern part of the state. **Pyramidula strigosa** Gld., var. **cooperi** W. G. B., is found along the shores of the lakes and along the damp banks of the streams. Apparently some of the lower forms have ascended, becoming accustomed to altitudes above the lakes and rivers, and being able to live on the mountain sides during the damp spring months, in summer disappearing from sight until the following spring. As the ascent was made and the struggle became fiercer the size of the shells became reduced, this form being much smaller than the variety **cooperi**. But still others ascended to higher realms and are now found on the highest and bleakest of rocky slopes. This **P. strigosa** var. **alpina** is no doubt the result of this gradual ascent. In size it is small, being really diminutive. The struggle is great. Food is scarce. To support so large a body as the small form lower down, or the ordinary specimen at the lake or creek, is impossible. Consequently, there has been a change in structure to accommodate the changed conditions, and the shell is much reduced in size. The form, cooperi, has not been found by the writer above 4,000 feet. The small variety is found from 5,000 feet to 7,000 feet in the west, and higher in the east. The diminutive variety has been taken on this occasion at an altitude of 8,500 feet and from that nearly to the top. The same diminutive shell was later taken on McDonald peak at an altitude of 8,000 feet to 9,000 feet.

Plate XXVII will give the reader a better idea of the size and relationships of the shells before mentioned than can be obtained from a description.

The summit was reached at 4:15 in the afternoon. It was completely bare of vegetation save for one little straggling specimen on the western edge, catching the rays of the sun, and not sufficiently far along in growth to make a determination. The aneroid registered 9,150 feet. Although the sky was cloudless a few pellets of snow came from some place and struck us in the face. At our feet was an immense snow drift on which the camera was planted and which was covered with goat tracks.

The sight was fine. No one can tell the glories, beauties, or depict the awfulness of the view from one of the heights of the Mission range. To the west is the twin peak of the one we have ascended, showing beautifully the stratification, and the formation of the mountain. Beyond this peak the mountain drops almost abruptly to the plain. To the north the range appears as one vast jumble of peaks and ridges, though of course there is order in it all. Reference is made to the impression. To the east the Jocko peaks rise abruptly from the snow fields, old snags that appear incapable of being ascended. A view of these is given in Plate XXI. Between Sinyaleamin and the Jocko peaks is a large glaciated region, no doubt the former ice region supplying the material for the moraine at Sinyaleamin lake, or the lakes toward the east. At the foot of the old Jocko crag is a small lake, filled with slush snow and ice, as viewed from our distance, and which has been christened Snow lake in consequence. This Snow lake is in the drainage of Sinyaleamin lake, the waters entering Snow lake, overflowing, passing down over the rapids into Sinyaleamin lake, and on to Mission creek. To the south Mount Lo Lo, in the Bitter Root range, may be seen 75 miles away. The Bitter Root range, Cabinet and Swan ranges, the Mission range in the foreground, the Kootenais and the Rockies, make a grand and beautiful panorama. Thirty miles to the north may be seen Flathead lake, blue as the sky above. The Mission range shows up grandly. It is a magnificent sight.

The descent was made along the ridge to the southeast, so as to descend the middle ridge of the mountain instead of the western one. The descent was begun at 5:35, and was devoid of interest save that the trip was exceedingly difficult and tiresome. In an evil moment a ravine was selected, which was followed for some time. In one respect this was fortunate, as late in the evening a movement was seen in the bushes ahead indicating a bear. The head man immediately dropped to his knees. A black patch about the size of a man's hand was all that could be seen, and instantly it was fired at. The surprise of the mountain climbers was great to behold a monster porcupine roll over into the ravine. He was big and heavy, and it was nearly 4,000 feet of a descent to camp, and already getting dusk, owing to the fact that we were in the ravine. Tying his legs together the beast was slung across the back of one of the men, and the descent in earnest began. This was the largest porcupine ever seen in the region. Indeed, porcupines in this section of the state are scarce, and many an old timer has no recollection of ever having seen one. When 2,500 above camp a scheme was resorted to in an effort to arouse the camp which is worthy of mention, as it may be used by any one in any locality. The idea belongs to Prin. Silloway, though it may be commonly known. Taking a double-barrelled gun, opening the breech, and blowing in the breech end as in a conch shell a noise is made that is deep, heavy, and resonant, and may be heard a long distance. The noise made on this occasion was clearly heard in camp a half mile below, and much farther by the road we had to travel. Also, we could hear their reply, though told afterwards that all had called together at the top of their voices in order to make us hear. This blowing on the gun barrel is the cheapest whistle a hunter can buy, and will carry the sound farther than any on the market. Late that night, about ten o'clock, the party arrived, tired and hungry, as is usual in the mountains, but well paid for the trip.

ORNITHOLOGY AT SINYALEAMIN LAKE.

Animal life around the lake is interesting, but not abundant. The ornithologists followed the birds from daylight until dark, which is most of the time when the days are so long. The nesting season had apparently closed, and not a single set of eggs was taken or seen.

While the list of birds seen at this lake includes 39 species which is a fair number, there was no abundance of any species. Owing to the character of the banks traveling was difficult. The waters of the lake harbored little food, and aquatic life was relatively scarce. In the dense arbor-vitae woods at the head of the lake the carol of the winter wren was frequently heard, while in the cascade the American dipper boldly dashed back and forth in the spray. A pair of wandering loons once rested over night on the lake. The American golden eye now and then made appearance on the lake. Along the shores the spotted sandpiper was not uncommon. In the woods Richardson's grouse and ruffed grouse were frequently flushed. A desert sparrow hawk, pursued by pine siskins, was seen when high up on the mountain. The belted kingfisher was common around the shores of the lake, and in the woods might be seen woodpeckers of several species. Cabanis's woodpecker was not uncommon, Batchelder's woodpecker was occasionally seen and heard, one pair of red-naped sapsuckers was seen for a day, the lordly pileated woodpecker made announcement of his presence by his loud call and hard and slow pounding on the trees, while the red-shafted flicker was seen and heard daily. At dusk the western night hawk occasionally was seen in the air, while during the day, strange as it may seem, an occasional humming bird was seeking food from the various flowers about the lake. The sharp and far-away sounding call of the western wood pewee was frequently heard on the hillside. Wright's flycatcher was common in the timber south of the lake. The black-headed jay was not uncommon, and a single curious Rocky Mountain jay was one day seen lurking around camp. Higher up on the mountain, above 4,700 feet, Clarke's nutcracker was found. In the woods adjacent to the lake the American crossbill was common, and pine siskins were frequently noted in the air overhead or occasionally were seen in camp having come for crumbs. Everywhere on the reservation where observations were made the western chipping sparrow was found. Around the lake Shufeldt's junco is abundant. Black-headed grosbeaks were not seen about the lake, but at the ponds a mile to the south they were abundant. The brilliant Louisiana tanager was everywhere to be seen, while the handsome cedar waxwing was frequently noticed at the pond with the grosbeaks. The red-eyed vireo, warbling vireo, Audubon's warbler, Townsend's warbler, and Macgillivray's warbler were the insect feeders noted in the trees. The Rocky Mountain creeper was only occasionally seen, though the slender-billed nuthatch is common. Every walk brought to view the long-tailed chickadee. The notes of the olive-backed thrush were regular features of the woods. A single pair of western robins were feeding the young on the nest during the stay at the lake.

The region seems to be a place of resort for birds, where they come for a time and disappear, as is the case with the region as far as man is concerned. Later investigations may reveal more.

CONCHOLOGY OF SINYALEAMIN LAKE.

One would expect to find an abundance of shells in and around such a body of water as this lake. In this, as in many other points, there is disappointment. These clear cold lakes do not offer a large supply of food for such dainty feeders as shells and the supply is not abundant. The small alpine form, **Pyramidula strigosa**, var. **alpina**, has been previously referred to as having been found near the summit of the mountain. In the woods along the borders of the lake the larger **Pyramidula strigosa** Gld., var. **cooperi** W. G. B., was taken rather abundantly. With the preceding **P. solitaria** was found in less abundance.. Only a few **Polygyra townsendiana** Lea, var. **ptychophora** A. D. Br., were taken. These two have so far been found together, the former most abundantly, the latter much less so. These four land species were all that could be found. In the water three more species were taken, all sparingly. **Physa heterostropha** Say was not abundant, but several large and very fine specimens were taken. Now and then **Planorbis trivolis** was seen.

Nearly an entire afternoon was spent at the outlet attempting to secure a few of these two species, and the result was not very flattering. An Illinois bog would produce a thousand for one. The most noticeable snail, and the most difficult to secure, was **Limnaea emarginata**, a small variety. The same species was found very abundantly in McDonald lake fifteen miles further to the north, and is also in Swan lake across the range east. In Sinyaleamin lake the shells are for the most part singly on stones in the bottom where the water is shallow, or along the bank. They are very light in color and very conspicuous. To secure them it is necessary to take a boat, row slowly where the water is shallow, and when one can be seen wait until the water becomes smooth and either pick it off by hand if not too deep, or by some other method. As there is much trouble to determine the depth of the water on such occasions the task becomes quite difficult, and the result is often a wetting. Our best success was to take an insect net, and with this gently pull the shell off the rock by inserting the net under the snail, thus letting the animal fall into the net. Even this is slow work. The snails have the peculiar habit of letting all holds go when anything touches them, falling to the bottom among the pebbles, where it is very difficult to see them. An entire afternoon was spent fishing for these specimens, a couple of dozen being the number secured, and many getting away. It is readily seen from this that a small bottle may hold the entire catch of an afternoon. Notwithstanding the difficulties, the snails present many interesting points, and are well worth the effort. No bivalves were seen anywhere

By comparing these notes with the record of McDonald lake it will be seen that the snail life of the two regions is very similar.

The butterflies noticed were not numerous. Those seen were **Colias eurytheme, Basilarchia lorquina, Vanessa milberti**, and a species of **Lycaena**. These latter were collected in small places where the butterflies seemed as close together as they could get, as many as 75 or 100 being collected in one small space. No effort was made to make a collection of moths or butterflies, attention being diverted in other directions, but on account of the cold water and the limited vegetation it is not likely the best place to seek such insects in quantity.

ENTOMOSTRACA.

Dredgings and surface catches were made during each day of the ten spent at the lake. Altogether 39 vials were filled, each representing a catch. Usually the catch represented fifty strokes of the pump. It was our custom to take a surface pumping, then attach ten or fifteen feet of hose, afterwards 25 feet, then 50 or 75, then 100, afterwards all that could be put together, 140 feet. It was soon discovered that during the day very few entomostraca were at or near the surface, though they were always to be found late at night or early in the morning near the surface. To seek a solution of the problem pumpings were made late at night, before daylight in the morning, and during the day. It was observed that light was not suited to these animals, and that as soon as day dawned they sank to a depth of 25 or 30 feet, remaining until dusk, when they again returned. These observations were verified later in McDonald lake, in Flathead lake, and Swan lake. It was found that to secure specimens in day time the hose must go to a depth of 25 or 30 feet, while at night they were as numerous at the surface as any place else. These diurnal movements are very interesting. It does not appear that the movements are in schools, but that the movements are everywhere uniform.

These observations are not in accord with those made on Flathead lake on July 6. At that time **Cyclops pulchellus** Koch was exceedingly abundant on the surface of Flathead lake, in great numbers, on a bright sunshiny day.

Observations showed that life at night was most abundant at the surface, the quantity decreasing toward the bottom, until at the lowest point reached by the appartus, 140 feet, but few forms and relatively few of each species, were found. Life in the lake is scanty as compared with that in the shallow ponds near the lake, and small ponds found at other places. Yet considering that the water is so clear and cold and contains so little food the life appears abundant.

The most abundant species, which had practically entire control of the lake was what appears to be a new species of **Diaptomus.** The next was **Daphnia thorata** Forbes, a species allied to **Daphnia hyalina** Leydig. **Cyclops Americana** Marsh was rather abundant. No amphipod crustasea were observed in any place.

The work in this lake was made possible only by the use of a canvas boat which was secured on purpose for the work, and which served its purpose admirably. See Plate XXVIII. This boat was 14 feet long, and carried about 800 pounds as the largest load given it, carrying this in perfect safety. The only boat on the lake was an Indian scow found near the upper end on the shore, which the boys towed to camp and fixed up so as to be serviceable, but which was very unwieldy and could not be used to any advantage. It was jocularly termed the Oregon, but was not used to any extent, and would never have been found save with the canvas boat. The canvas boat, Daphnia, was used constantly to transport the collectors to different parts of the field at the lake, and to go across and from end to end. It was in use most of the time by some one, was light and easy to handle, and was a general favorite. The boat was a source of much examination on the part of the Indian visitors both here and at other portions of the reservation. They seemed to think it was good for any kind of a trip, and an invitation was extended later to take a badly wounded Indian with a well friend a distance of 20 miles on Flathead lake, and the same distance returning. Needless to say the offer was not accepted. It was with much hesitancy a canvas boat was taken, fearing it would be unserviceable, but it was a complete success. In a short time after landing at the lake the boat was in use and was readily packed up when camp was broken.

By following the canyon leading south toward the Jocko for a distance of two miles there are to be found several ponds. The first one is small, and at the time of our observations contained little water, though much life in proportion. In fact the first pond was not much more than a puddle. This was in the canyon before it had widened much. But a little farther the canyon widens considerably, making a pond covering several acres, and still further widens into a beautiful park with fine timber of yellow pine and tamarack, with a pond much larger than the preceding. How many more may be beyond is not known. Reference has been made to these ponds under the remarks on ornithology. They proved to be very interesting from the entomostracan standpoint.

As the boat was not taken to these lakes the hauls were made by throwing the net out from shore with a long line and pulling it in. It was difficult to secure a haul more than thirty or forty feet from shore. On one occasion the pump was taken and pumpings made.

The entomostraca differ radically from those found in Sinyaleamin lake, some two miles distant. The species identified are **Diaptomus leptopus** Forbes, **Cyclops serratulus** Fisher, **Moindaphina**, probably **alabamensis**, and **Cyclpos signatus**. Not a single one of these species was found in Sinyaleamin lake, and not a single species found in the lake was taken in these ponds. As the ponds are shallow and the water warmer, besides having different food conditions, it is probable there would be a difference in the two lakes, but no such striking difference was expected. From a casual observance the idea was gained that the lake possibly had an outlet through this canyon, but the life in these ponds does not confirm the idea, but opposes it.

One surprising thing at these ponds was the scarcity of dragonflies. It would appear that this would be an admirable place for these insects to breed in, yet very few were seen. From this it will be inferred that the ponds freeze to the bottom in winter, thus killing the most of the larvae, but this is only conjecture. It is also possible that the numbers of birds in the region may keep them pretty well killed off. At any rate, they were scarce. **Aeschna constricta**, **Sympetrum obtrusum**, and **Enallagma calverti** were the only species observed. Not an **Ischnura** was seen.

The presence or absence of fish in these ponds was not determined, but all the evidence was negative. The ponds gave the impression from appearances that they would go dry in some seasons. If so the absence of fish would be accounted for, as also the absence of much other life one would expect to find.

One of the conspicuous features at the lake from a botanical standpoint was the abundance and beauty of the lichens. This is noticed in many places in the state, and in some places even more conspicuously than here. The lichens cover the trees in many places. Several species were taken in great abundance at camp. In breaking off dead limbs for firewood the choice specimens covering the small limbs were saved, thus procuring in abundance some fine specimens. At the upper end of the lake a beautiful species of Lycopodium was discovered, with long green trailing vinelike stem, several yards in length. In the woods a species of mushroom belonging to the Polypori was found growing quite luxuriantly, but mushrooms appeared very scarce.

From Sinyaleamin lake camp was moved to McDonald lake, fifteen miles north, in the Mission range. But the distance necessarily traversed to reach the latter lake is much more than the distance by crow's flight.

McDONALD LAKE IN THE MISSION RANGE.

The road to McDonald lake from St. Ignatius Mission is good. The distance is about 11 miles. Most of the distance is across the level valley, the last two miles being a very stiff up grade, causing a hard pull when there is a load.

Camping sites at the lake are scarce, owing to the nature of the lake. There is but one portion of the lake, the western end, free from cliffs or rocks. Most of this is densely wooded with timber and heavy underbrush. By fording the outlet, possible in summer when the water is low, a camping site sufficient for the party was found, on the bank of the lake, in plain view of the peak, free from underbrush, and above all, in a place where the cool breeze from the mountains after sundown drove away the mosquitoes, which are much of an annoyance in the region in early summer. The camping site was a delightful place, and a stay of ten days in 1900 was made in order to make collections, and search for living species of the shell **Pyramidula elrodi** Pils., as well as to study the entomostraca of the lake. A camp of a week in June, 1901, was made for the same general purposes. Plate XXIX gives a good view of the lake from the outlet.

McDonald lake of the Mission mountains lies at the foot of McDonald peak on the northwest. Like Sinyaleamin lake, it is hemmed in on all sides except the west by mountains, save that they are much higher, more picturesque, and steeper. The lake was named McDonald back in the sixties, and according to priority the name should easily displace that given to Terry lake, also called McDonald, which lies northeast of Kalispell.

The valley enclosed by the peaks, in which the lake now is, has been carved out by a glacier, or more properly by glaciers, as there were undoubtedly several uniting to form the main glacier which flowed down the valley. Remnants of these glaciers are yet seen on the mountains, there being three on McDonald peak, one in plain sight from almost any point on the lake. The rocks along the lake have been ground smooth, and show plainly the marks of the ice. At the outlet of the canyon a large moraine has been made, though not so advantageously situated for damming the water as at Sinyaleamin lake. But the water has in time past evidently been much deeper that it now is. The rock on the north is fast disintegrating, and is filling up the lake with red mud and ooze. At the upper end is a wooded valley which formerly must have been a part of the lake. The filling in has drained this part of the lake, the remainder of the lake not yet being filled up. The present lake is therefore but a part of what it was formerly.

The lake is smaller than Sinyaleamin lake and not nearly so deep. It is a mile to a mile and a quarter long, the average width being less than a quarter of a mile. On either side the mountains come abruptly to the water, as may be seen in the illustration given, Plate XXIX. As has been stated, there is a valley at the upper end, so far unexplored, and densely wooded with arbor-vitae, several species of fir, white and red birch, and other smaller shrubs. The inlet divides above the lake, one branch receiving water from the glacier visible, the other bringing the water from the amphitheater toward the east, which has for drainage not only the peaks visible, but also the eastern slopes of McDonald peak. A general view of the upper end is shown in Plate XXX.

The bottom of the lake is comparatively level and from the mud on the bottom the impression is gained that the lake is either older than Sinyaleamin or has filled up much faster. The depth from end to end is nearly uniform, the deepest being eighty-four feet. The lower end is shallow, the outlet being crossed by a ford, hub deep in July. There is considerable shallow water. The mud at the bottom is of a reddish color, apparently from the decomposition of the rock on the north shore. At a point near the middle a ledge of rocks projects from either side, making the lake at this point quite narrow. The ledge is precipitous, and the water a few feet from the rocks is deep. These stones are worn smooth by glaciation, and show deep and numerous glacial scratches.

On the north, to the left in the illustration, Plate XXIX, the rocks are very steep for about 2,000 feet. Shale and cliffs alternate. By much hard work one can reach the top of the talus. Above is a mass of precipitous rock, not to be ascended from this side. Four waterfalls, with small streams, tumble over the rocks. The waters disappears in the loose talus at the base long before it reaches the lake. The southern slope is not so abrupt. Large masses of loose talus, with large boulders, line the water's edge, making a loose and spongy surface for the retention of moisture.

Life in and around the lake is not abundant. There are few frogs, and probably no snakes, as but one of the former was seen during the ten days and none of the latter. On the rocks at the water's edge, altitude 3,300 feet, several pika, **Lagomys princeps**, were killed. This is the lowest altitude known to the writer at which these peculiar animals have been taken. They are abundant on the peak at 8,000 feet and over, but none were taken, owing to the difficulties in getting them when killed among the crags at these high altitudes. The banks of the lake are so steep and rough that it is all but impossible to climb along. Almost an entire afternoon was spent in going the length of the lake a few hundred feet from the water's edge. An exploration will probably show great possibility of increasing the size of the lake by overflowing the valley at the upper end, if it shall ever become a necessity to use this lake as a reservoir site.

On the northern side the timber is not so dense, owing to the nature of the rocks. The banks are steep, and the cliffs afford poor hold for the roots of trees which have not gained much headway. On the mountain above the precipitous rocks the timber is quite heavy, being largely of yellow pine and fir. The southern bank is well wooded. The canyon at the head of the lake is densely wooded, through which there does not appear to be an entrance made by road or trail. At the outlet and along the moraine near the lake there is fine timber, some of which has been cut for rails and lumber. Everywhere there is much underbrush, making progress difficult.

The road to the lake is good, considering it is a mountain road. There is some travel over it. The lake is a great resort for the Indians and those who visit the reservation, on account of the excellent fishing and beautiful scenery. There is no drift around the shores, most of the drift having lodged in the outlet. Here there is a quite a jam.

CONCHOLOGY OF McDONALD LAKE.

Search was made daily for shells. In the waters there were large numbers of a new variety of **Limnaea emarginata** Say, described in Nautilus, Vol. XV,* as var. **montana**. This is the same shell that was previously taken in Sinyaleamin lake with so much labor, and was much more aboundant in McDonald like than in Sinyaleamin. Along the rocks in the middle of the lake they were taken in considerable numbers, and at the outlet others were taken among the grass and weeds in the shallow water. This species seems to relate **emarginata** to **stagnalis**, some of the shells showing the malleations of **stagnalis** quite plainly. Placed side by side they have many points in common, but are very much smaller than the variety **appressa** of **stagnalis** taken in western Montana.

Physa ampullacea Gld. was found sparingly, not so abundant as in Sinyaleamin lake. Strange to say, not a single specimen of **Planorbis** was seen. **Planorbis** seems to be a warm water species, and while a few were taken at Sinyaleamin lake, they were very scarce, and the few taken were small and badly broken. In the small ponds and lakes in the valley to the west of the Mission range **Planorbis trivolvis** is exceedingly abundant, and in the small lakes or ponds of glacial origin along Flathead lake these shells are found in great numbers.

Among the underbrush at the lower end of the lake **Pyramidula strigosa** var. **Cooperi** was found in large numbers, as also **P. solitaria** Say. These two species have been considered distinct heretofore. A large series of several hundred was assorted with the attempt to make two species. The most widely different were easily separated, but by this process of elimination those remaining were more and more difficult to place in one species or the other, and the last remaining could apparently go as easily in one pile as the other. From external appearances it seems difficult to distinguish some of those found at this lake as belonging to either the one or the other species. The two were found in the same locality, were picked up together, and were placed in the same receptacle. It was impossible to do anything toward working out life histories, and internal anatomy may reveal differences that external anatomy does not disclose. But as descriptions of shells are largely based on external anatomy it is doubtful if these two species are distinct. It may be well to note here that all the shells taken so far at the upper end of Flathead lake are **var. cooperi**, none having been taken that could be called **solitaria.**

Having found a very small variety of the shell **Pyramidula strigosa**, called **alpina**, at high altitude on Sinyaleamin mountain, it was thought the same shell might be found on the heights of McDonald peak. A short description of the trip in search for this shell is given in the succeeding pages. Sinyaleamin mountain is almost due south of McDonald peak, in the same range, the distance between the two peaks in air line being

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* Nautilus, Vol. XV., p. 111.

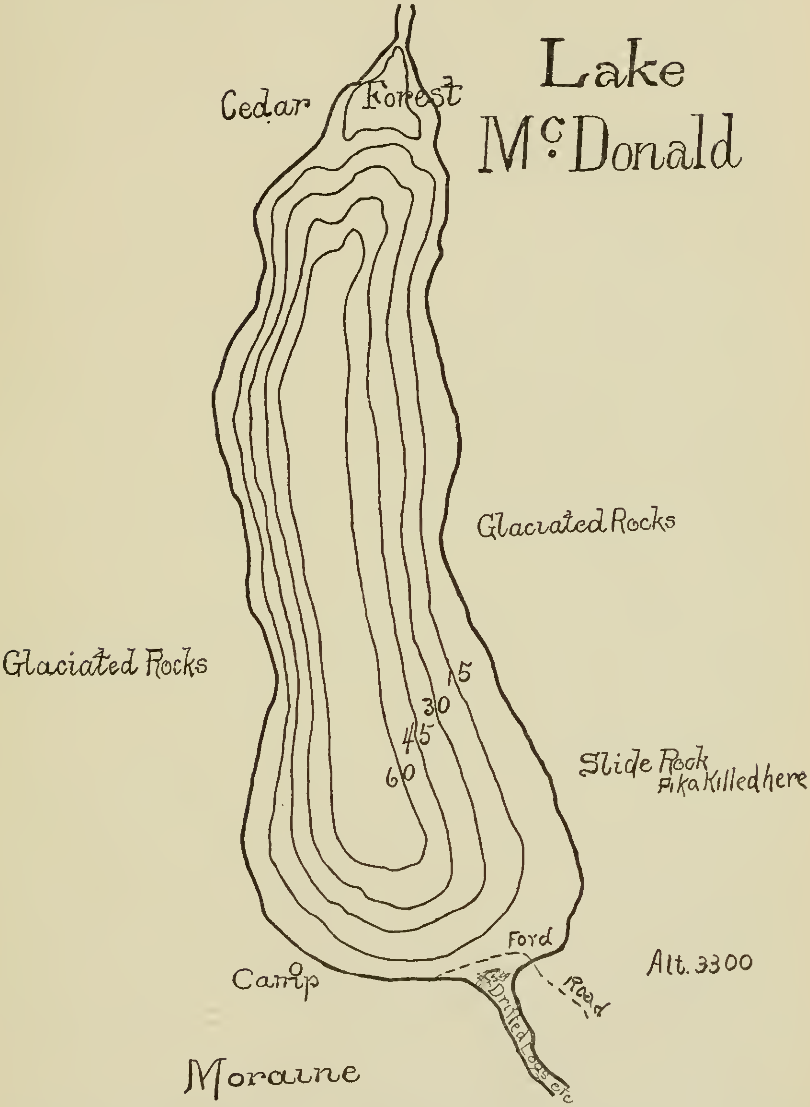
Lake McDonald
Cedar Forest
Glaciated Rocks
Glaciated Rocks
15
30
45
60
Slide Rock
Pika Killed here
Ford
Camp
Road
Drifted Logs etc
Alt. 3300
Moraine

Fig. 2. Diagram of McDonald Lake, showing contour, depth and shore characteristics.

something like twelve or fifteen miles. On the assumption that the shells would start from the water course, and possibly follow the ridge on the shady and damp side, they must have taken entirely different routes in ascending the two peaks. They were found abundantly on McDonald peak at the altitude 7,800 feet to about 8,500 feet. It is worthy of note that the shells seem to begin and end rather abruptly. When first found, on either mountain, they were found in considerable numbers. The high summits of McDonald are so steep, and the broken rocks so large in size, that there seems a limit to the range of the shell on McDonald. From our observations it appears that on the south side of Lake McDonald thre is a break from the slopes immediately above the lake, with altitude about 3,400 feet, to 7,800 feet, in which no **strigosa** have been found. They are probably there, but sparingly, since diligent search was made during the ascent. On the other bank, however, the northern slope, **strigosa** has been taken from the lake to altitude 7,500 feet, and continuously. Moreover, the shells taken at the high altitude on the north slope are many times the size of those taken on the opposite mountain. The locality in which the shells were taken on McDonald is on a ridge facing the west, bare of trees and other shelter, wind-swept, and storm-swept. On the north, on Teton mountain, the ridge faces the west, but is well wooded and protected, and apparently retains moisture much longer. To conchologists and others the wanderings of this shell will be of much interest, and the description has been given in some detail bēcause of that interest.

A good series of **Polygyra tawnsendiana**, var. **ptycophora** was secured. The underbrush was so dense that it was necessarry to crawl on hands and knees most of the time among the shrubs and small trees. By digging in dead logs, overturning decayed stumps and branches and pulling apart dead leaves a good series was obtained, but at the sacrifice of clothing and flesh.

Of these three species many were found eaten by squirrels. These were carefully preserved, and examination made of the method of procedure. The usual method was to break the shell at the apex of the spire, making a good sized opening. Through this the animal was drawn and no doubt afterwards devoured. A few openings were made at other places, and sometimes at very unfavorable places, due no doubt to lack of experience on the part of the enemy. Of the species **P. strigosa, var. cooperi** fifty were found thus broken into. Of **P. solitaria** four or five more than of **cooperi**, while **P. townsendiana**, var. **ptycophora** had but two thus eaten. As these latter much more resemble the surroundings than do the striped **Pyramidulas** this is not surprising, and is a good illustration of protection.

On the talus north of the lake the bleached remains of a hitherto new shell were lying abundantly on the rocks. During the short stay at the lake in July, 1899, some forty specimens of this shell were secured, Pilsbury described it as a new species in Nautilus, Vol. XIV., P. 40. The species is shown in Plate XXXII. It certainly is a species as distinct as many other described species, and certainly is unlike any other shell so far described in many respects. Whether or not intermediate forms will be found which will destroy the identity of the species is to be determined. During our stay of ten days at McDonald lake several days were spent almost entirely in searching for both living and dead specimens. More minute descriptions of the results of this search have been given elsewhere, and need not here be repeated. It is sufficient to say the living shells were found. The first were taken high up, on a small space on the top of a crag where there was a little decaying rock, while trying to get a good position for a photograph of the peak opposite. The success on this occasion spurred to greater effort, resulting in finding other living shells nearer the water's edge, by going deep among the talus toward moisture. But none living were found among the rocks close to the lake. The net results of this search were several quarts of shells, with several dozen preserved animals, some of them beautifully expanded.

This shell, Pyramidula elrodi Pils., appears to have a very limited range. It is found abundantly on the northern shores of the lake westward to the last stream of water trickling over the rocks, when it ceases abruptly. On the southern shore of the lake it is found very sparingly, but a few being found as the result of an afternoon's search, among them a single live one. There is good reason for believing they occur along the slopes of the mountains that form the amphitheater above the lake, bordering the valley mentioned, as otherwise their presence on the south side of the lake is not accounted for. They have been found up on the side of the mountain as far as explorations have been made, up to 7,500 feet, and still seem to continue. How far up the mountain they are to be found is problematic, and should be determined. Diligent search has so far not revealed the species at any other part of the Mission range. It is expected later to make collections on the east side of the range, when search will be made for the shell there. Search for shells during succeeding years has failed to produce a single speciment from other localities than the one here described. The distribution therefore seems to be extremely limited. The amphitheater may better understood by consulting Plate XXIX.

The shell is not only a land form, but is a rock form. It seems to have a preference for nooks and crevices on the summit of some cliff. In searching for them it was discovered they were most abundant along the water courses, where vegetation had not yet gained a foothold. It was unnecessary to search among the debris collected at the roots of a clump of bushes, but if there was an open space where the talus was loose and open they were likely to be found. In the spring time they evidently crawl over the brown lichen covered rocks in search of the lichen food, crawling beneath when the warm days come on and the moisture on the rocks dries up. The few remaining too long are killed, their shells bleaching from a dark flesh brown to a beautiful pearly white, It is described by an admiring friend as the queen of the Pyramidulas. By digging among the damp talus a few live ones may be found. Higher up, where there are small springs from the mountain side, they may also be found.

During the season of 1901 a week was spent again at McDonald lake in the last of June. It was the rainy season. In three weeks there were but three or four days of sunshine. While this bad weather was hard on those living out, as we were obliged to do, it was the best time of the year for collecting . One day while at this lake the rain came down almost the entire day. It was just such a day as would be good for land shell collecting, and rigged out in gum boots and a slicker the writer spent the greater part of the day crawling through the wet underbrush in search of shells. They were found in great abundance. **P. strigosa** and **P. solitaria** were out in great numbers. It is no exaggerations to say that if one had desired to do so he could have secured a peck of these two species. With them was now and then found a **Polygyra townsendiana,** var. **ptycophora,** but they were in no great abundance. Considering the small territory examined the number of shells to be had of these two species in the region of McDonald lake is very great. As it is the collection taken and brought to the University of Montana was more than a thousand specimens from this field alone.

The camp was made primarily to secure further information relative to **P. elrodi** Pils. Immediately after a rain the rock talus on the north bank of the lake was examined. The rocks were very slippery, the grade steep, and the bushes dripping with moisture. Rain fell a portion of the time. But **P. elrodi** was at home. Large and small, they were everywhere in abundance. In 1899 but a few bleached shells were found on the exposed rocks. In 1900 a much larger number of bleached shells was found, together with a few live ones. They were also followed up the mountain slope about two thousand feet. But during the camp of 1901 large numbers, of all sizes and apparently all ages, were taken. They were crawling over the rocks in plain sight, though almost invisible save by close scrutiny, owing to their resemblance in color to the rocks, and were traced up the mountain to an altitude of over 7,500 feet. At this altitude the dead shells with occasional live ones, were still abundant. As we had started up the mountain in the afternoon it was impossible to go farther that day, and the return was made to camp, with plans for ascent to the end of the shell region. That night a storm prevailed, and we concluded from indications we would fare better out of the hills, and got out, none too soon. The next morning the hills were white with new snow, remaining so for a long time.

In making this search up the mountain a shell was found which is undoubtedly a hybrid between **P. elrodi** and **P. solitaria** or **P. strigosa.** It has the form and sculpturing of the former, and the characteristic band markings of one or the other of the latter. Which of the latter it is difficult to determine. But as **strigosa** was much more abundant along the ridge than **solitaria** the hybrid is probably **elrodi** and **strigosa.** The shell is of a young specimen, less than half grown.

P. elrodi is not the only shell that made the ascent of the mountain. Associated with it, even to the highest point, **P. strigosa,** and **P. solitaria,** in varying numbers, were taken. The result, is a fine series, from altitudes from 3,300 feet to 7,500, which will afford material for working out the results of altitude.

It is not inappropriate to quote the following paragraph in reference to **P. elrodi** and its home.

"It is a shell of the rocks. It lives among the crags of the Mission mountains, where there is scant vegetation, preferring the crannies at the top of some cliff, where large colonies have been found. Among the loose rocks it finds a home, hides from its enemies, thrives during the springtime when snows are melting, and, later, when the rocks are dry and hot, crawls beneath where there is a little moisture, throws a transparent film across the opening of the shell to prevent evaporation, and awaits the coming of the next season. Those animals which have not sought the damp and cool crevices early enough are prostrated by the heat. They soon die, and their bleached and empty shells may later be found by the collector who is so fortunate as to be in their locality. They do not like the bushes. It was found unnecessary to search the rocks about clumps of bushes, for none were there. But on exposed places, where the rocks were bare and clean, dead shells were found, and by digging below an occasional live one was secured. I envy this shell its home. It is one of the most beautiful spots of the beautiful Mission range. The grand old peak, McDonald, is constantly in view, its rocky crest most of the time covered with snow. Below, smooth and placid, McDonald lake invites attention. To the west a little water fall tumbles over a rocky cliff, and the water disappears in the loose talus below. Anon an eagle circles in the heavens, and the American raven casts a silent shadow as the bird passes over. The wild laugh of the loon rings in the air at midnight, and mountain goats browse on the vegetation above. Clouds gather at the summit of the peak, and fierce lightning on a moonless night illumines the sky with vivid and lurid light. The thunder-peals roll from crag to crag, and with deafening crash startle every living thing. Again the day is clear and the sun is bright, sunshine such as only a mountain region can give, and all is quiet, serene, and beautiful. Perhaps for countless years these varied scenes have been enacted. The home of this beautiful shell is as beautiful as the shell itself, and the carving and sculpturing which have been given by Nature as an adornment to the shell are but a miniature of the immense ridges and ravines everywhere abounding."

The shell life of McDonald lake is therefore seen to be very interesting. While there is no large list of species, those to be found are in good numbers, and the collection of shells made at this camp was very satisfactory.

ORNITHOLOGY OF McDONALD LAKE.

Bird life at McDonald lake is similar to that at Sinyaleamin lake, as was to be expected. The rugged condition of the country prevented extensive collecting. The woods and brush at the outlet of the lake were the most prolific places examined, and notwithstanding the dense brush and the attending difficulties, were the only places where much collecting was done. A two days' trip to the summit of the peak brought in several specimens, but the bare ridge ascended was comparatively free from bird life above the forest belt, and below that most of the time was employed in hunting a way for ascent. Around the lake the effort to take birds was exceedingly laborious. The ornithologists made strenuous efforts to search the shores of the lake, but it was almost impossible to get around. More collecting was done at camp than at any other place. Once Prin. Silloway shot a Townsend's solitaire, a very interesting catch. It fell five hundred feet down a cliff, entailing a half hour's work to find it and recover the ground lost. Unidentified raptores circled above him in perfect disregard of futile efforts to secure them, as he describes in his report.

As usual at our camping places, the spotted sandpiper, **Actitis macularia L.**, was common along the shores of the lake. On the slopes toward McDonald and elsewhere on the hills Richardson's grouse, **Dendagapus obscurus richardsoni** Dougl., was not infrequent. Franklin's grouse, the fool hen of popular reputation, was common in the vicinity, **Dendragapus franklini** Dougl. The gray ruffed grouse or pheasant, **Bonasa umbellus umbelloides** Dougl., was common in the thickets along the water courses. The sharp-shinned hawk, **Accipiter velox** Wils., was found regularly near the lake. **Accipiter cooperi** Bonap., Cooper's hawk, was common along the cliffs of the lake, but were on such inaccessible pinnacles that they could not be taken. The western red-tail, **Buteo borealis calurus** Cass., the American rough-legged hawk, **Archibuteo lagopus sancti-johannis** Gmel., and the desert sparrow hawk, **Falco sparverius deserticolus** Mearns, were all seen about the lake. The only owl observed was the western horned owl, **Bubo virginianus subarcticus** Hoy, which is common in all the woodlands of the region. Its mournful note was not infrequently heard in the evening or at night.

A single pair of kingfishers, **Ceryle alcyon** Linn., seemed to have charge of the lake, and worked industriously at the inlet at the upper end of the lake, where the diverging streams from the main source made the fishing excellent.

Five woodpeckers in all were taken at McDonald lake. One specimen of the alpine woodpecker, **Picoides americanus dorsalis** Baird, was taken near camp. The rednaped sapsucker, **Sphyrapicus varius nuchalis** Baird, is a common resident near the lake. The pileated woodpecker, **Ceophloeus pileatus** Linn., was heard several times near camp, and notwithstanding much shooting two were taken almost from the tent door. This large and beautiful bird is reputed to be shy of man. It has been taken throughout the Mission range, and nowhere does it appear as shy as is reputed. Lewis's woodpecker is common in the valley below the lake, and in the tall pines is one of the most common and conspicuous birds. Every where the red-shafted flicker, **Colaptes cafer** Gmel., is common.

Occasionally at nightfall the western night-hawk, **Chordeiles virginianus henryi** Cass., was seen flying about. The rufous hummingbird, **Selasphorus rufus** Gmel., was a frequent visitor to the flowers near camp, and was a delightful bird to see. Along the rocky wall of the mountain the calliope hummingbird was several times observed, without doubt, among the flowers growing along the small water courses dashing over the side of the mountain.

The western wood pewee, **Contopus richardsonii** Swains., and Traill's flycatcher, **Empidonax trailii** Aud., were the insect catching birds other than warblers taken at this camp.

The American magpie, **Pica pica hudsonica** Sab., the black-headed jay, **Cyanocitta stelleri annectens** Baird, and the American raven, **Corvus**

corax sinuatus Wagl., were all seen around the lake, though in no great numbers. The raven was often noted, and repeated efforts were made to secure specimens, but without success. The only method of approach was by the canvas boat, and by this means the ornithologist was always visible. To enter the timber and get among the rocks was to get out of sight of the prey, and progress was almost impossible. The American crow and Clarke's nutcracker, **Nucifraga columbiana** Wils., were also seen around the lake, the former sparingly, the latter common at elevation of 7,500 feet and above.

The fringillidae, while not numerous in species, were abundant around camp at all times. Most abundant among the seed eating birds was the pine siskin, **Spinus pinus** Wils., which was everywhere about camp, usually high overhead in the tallest trees. The western chipping sparrow was almost as abundant, **Spizella socialis arizonae** Coues. High up on the mountain, at an altitude of 7,500 feet or more, Shufeldt's junco, **Junco hiemalis shufeldti** Coale, was taken, the range extending from this altitude down to the lake, 3,300 feet. Among the bushes along the mountain sides the call of the spurred towhee **Pipilo maculatus megalonyx** Baird, was heard, and several were added to the collection. The Black-headed grosbeak, **Habia melanocephala** Swains., the lazuli bunting, **Passerina amoena** Say, and the Louisiana tanager **Piranga ludoviciana** Wils., were frequently seen and specimens were added to the list.

On the eastern side of the lake a colony of cliff swallows, **Petrochelidon lunifrons** Say, had made their habitations in the rocks. The song of the red eyed vireo, **Vireo olivaceous** Linn., was frequently heard and the bird was not uncommon. In common with the warbling vireo **Vireo gilvus** Vieill. was heard, and now and then a specimen was added to the collection. Audubon's warbler, **Dendroica auduboni** Towns., was common in the woods, the most abundant of birds, perhaps, while not infrequently Macgillivray's warbler, **Geothlypis macgillivrayi** Aud., was noted.

In the rapids above the lake, and in the waters adjacent, might be seen the American dipper, **Cinclus mexicanus** Swain. The delightful carol of the winter wren, **Troglodytes hiemalis** Vieill., was often heard at the upper end of the lake, but so secretive was the bird that it was but seldom a sight of it was obtained, and then but a passing glimpse as the bird flitted to a new location, to again begin its song. The Rocky mountain creeper, **Certhia familiaris montana** Ridgw., was noted almost daily. Also the slender-billed nuthatch, **Sitta carolinensis aculeata** Cass., and the long-tailed chickadee, **Parus atricapillus septentrionalis** Harris, were seen.

A single young Townsend's solitaire, **Myadestes townsendii** Aud., was captured, and the adult was seen. These were the only specimens of this species seen on the trip. It seems to be very rare to the region.

The thrushes include the Olive-backed thrush, **Turdus ustulatus swainsonii** Cab., which was common, the western robin, **Merula migratoria propinqua** Ridgw., also common, and the mountain blubird, taken at altitude of 7,500 feet, but seen at the lake.

The bird life of the lake as here given proves very interesting. The camp of ten days produced forty-seven species, all of this being the result of the work of Prin, P. M. Silloway, who devoted his entire time to the study of the ornithological fauna, the results being given in detail elsewhere.

ASCENT OF McDONALD PEAK.

A party of six made the ascent of McDonald peak, taking two days for the trip, with the intention of gathering material from high altitudes. The start was made early in the morning, going as far that day as could be gone with a horse, which was taken to carry provisions, material, and blankets. The ascent for the greater portion of the distance from camp was through dense timber, where it was impossible to see out. The first steep slope, however, was open timber, full of ripe huckleberries, and where there was considerable evidence of bear. Soon, however, a dense growth of small yellow pines and fir, so thick a man could not enter them unencumbered, was encountered, barring the way. This small timber had been seen from below, and appeared to extend for a mile and a half or more, but from a distance the timber did not appear so dense as was found on closer inspection. It became necessary to either go around or return, and the former was decided upon; but even this was very difficult, owing to the growth right up to cliffs, making it difficult to get the horse through. After much toil and fatigue the ridge leading up to the main peak from the northwest was reached, when ascent became less difficult, and finally comparatively easy.

It is well to remark here that there is a well made trail to the highest point to which a horse may be taken, the trail leading up from a ridge near St. Ignatius, from which point many of the ascents are made. This trail was made in the early days, and over it many persons of note have travelled. By this trail it is possible to ride on horseback from St. Ignatius to snow. It is utterly impossible to take a horse to the summit. The nearest point to which a horse can be taken is about twelve hundred feet from the summit. The last twelve hundred feet require about four hours of hard climbing.

Camp for the night was made at an altitude of 7,800 feet, as shown by the aneroid. There was not much place for camp, the ridge being narrow, and the rocks rough. But by vigorous efforts each of the party hollowed out a place large enough to lie in. Rocks were piled up on the down hill side so as to prevent rolling over the cliff, which was but a few feet away. Rolled in a blanket, the night was spent here. The locality may be better understood by referring to Plate XXXIV.

The timber at this place shows the ravages of fire. The south side of the mountain in past years has been covered with a good growth of white-bark pine. These extended a little above our camping site, and for a long distance below. Fire had passed over the mountain in years gone by, killing the trees, but leaving them standing. The result may be seen by an examination of Plate XXXIV. At present the timber has not made a new start, and the ground is comparatively bare, and in the summer, from its southern exposure, becomes dry and parched. The opposite side of the mountain is a cliff on which nothing can grow.

At the time of our ascent a forest fire was raging below, filling the air with smoke, making it difficult to see in some directions, and materially interfering with the work we wished to do in photography. Over the range, in the Swan river country, another fire was raging. These fires were started by the Indians, if reports are true. A few days before as we were on our way to McDonald lake, the first signs of fire were seen by us when still miles away. It was remarked that the fire would reach alarming proportions if not attended to, and such was the case. It is difficult to care for fires started in this way, owing to the lack of transportation facilities, and also owing to the difficulty in getting help sufficient to extinguish them. The fire raged for several weeks, ascending the mountain higher and higher, until a fortunate rain extinguished it.

Immediately on making camp the work of collecting was begun. The botanist went energetically to work, and flowers were abundant whereever there was sufficient space and soil for a foothold. The rocks above camp were searched in the hope of finding more of the small shells, **Pyramidula strigosa** var. **montana**, which had been found for the first time on Sinyaleamin mountain ten days before. Sinyaleamin mountain could be plainly seen by us to the south, its snow covered peak being easily distinguished from the others. The shells had aroused so much interest among the party that all were interested in the search. Nor was there disappointment. A careful search of the rocks a few hundred feet above camp brought to light a couple of hundred specimens, among them several live ones. A careful search among the smaller stones, overturning them and examining the crevices, produced a collection that caused exclamations of delight from all.

McDonald peak is double, the western summit, the one ascended, being about a thousand feet lower than the eastern. The two are connected by a ridge, with a saddle or depression between them. To pass from the western summit to the eastern requires a descent of perhaps a thousand feet, then an ascent of perhaps two thousand. The western summit is easy of ascent, although the last 1,200 feet requires about four hours. But to ascend the main peak from the western summit seems difficult, though by taking the snow it is no doubt possible. Up to the present the main peak has not been ascended by the route from the west, with the exception of a rumor that the trip was formerly made by Indians. This statement has not been verified.

The main peak has three or four spurs projecting in different directions, behind or between which the snow lies in masses, glaciers apparently, remaining the year through. There is little snow on the western peak in summer, and its importance as a snow holder lies in the fact that it permits the snow blowing from the valley on the west to pile up between it and the main peak, thus making the glacier, visible from almost every part of the valley. These spurs make such protection that on three different places on the heights of this mountain the snow piles in drifts which never melt, making three large glaciers. One of these, the one seen from the lake, is shown in the illustration. The others lie behind the spurs. The waters from these three snow masses all flow into McDonald lake. The supply is therefore abundant and never failing. Moreover, the peaks to the north of McDonald peak, and which are also north of the lake, give much of their water to this lake.

The snow mass behind the spur to the left in Plate XXXV. flows into a small and beautiful lake, Leash lake. This lake is said by those who have seen it to be of surpassing beauty, usually full of snow, and visible only when almost upon it, so well is it hidden in the cliffs. The water entering the lake flows down the side of McDonald northward. After leaving Leash lake the water flows west, coming down and joining the stream from Teton on the north and the stream from the west glacier of McDonald.

Post creek, the outlet of McDonald lake, on the 30th of June, 1900, carried 473 second feet of water. The place at which the water was measured was some miles down creek from the lake, at a lower elevation than the lake by a thousand feet, and with considerable loss between place of measurement and lake through irrigation.

The Mission Valley.

This beautiful valley is bordered by the Mission mountains on the east, the Jocko river on the south, the Pend d'Oreille river on the west, Flathead lake on the north. The extreme length is about 35 miles, the extreme width about 15 miles. A terminal moraine separates the lake from the valley, bordering the lake on the southern end. The country immediately south of the moraine for a distance of ten miles is beautiful. It is level land, rich, capable of making good farms, easily irrigated. A large sand dune stretches across the valley about 15 miles from the lake, extending east and west. The eastern end is free sand, is not yet held in place by vegetation, and is slowly creeping eastward. The free and movable sand is 12 to 15 feet high, clean looking and white. Some eight or ten miles from this free sand westward one comes to the Pend d'Oreille river. The country abounds with depressions and coulees, with several large buttes from 100 to 200 feet high. It is in this region that the buffalo herd ranges.

The valley is crossed by four large creeks, as follows: Mission creek is the most southern. It takes its source in two canons, one the outlet of Sinyaleamin lake, the other Mission creek proper, with its high falls, visible for miles on the plain. Sinyaleamin lake receives its water from the eastern slopes of the mountains, principally from Snow lake, which is full of slush snow even in July. The stream leaving Snow lake tumbles over a beautiful cascade just before it enters the lake. The lake is described elsewhere. The stream from this lake joins Mission creek proper a short distance from St. Ignatius Mission. A third and smaller branch emerges from the canon between Mission canon and McDonald lake. This branch takes its rise in two small and beautiful alpine lakes, Twin lakes, lying high up in the mountains, fed by melting snows. Except in early spring this water is consumed in irrigation. Mission creek flows a little to the north of west, receiving Post creek a few miles west of the Mission, finally flowing into the Pend d'Oreille river, Mission creek may be located by examination of Plate XIX. Post creek is the outlet of McDonald lake, which receives most of its waters from the slopes of McDonald peak. The creek forming the inlet of the lake has two forks, one taking the waters from McDonald peak, the other from the peaks immediately to the north. This northern branch flows through two small lakes, and has some beautiful cascades, seen plainly from McDonald peak. Neither of these branches is known save for a very short distance from the lake. Post creek flows southwest into Mission creek as previously mentioned. Crow creek takes its rise in the mountains still farther to the north, in the canon through which runs the Crow creek trail. This trail is the Indian route across the range to the Swan river and Big Blackfoot river country. As it crosses the range at a high altitude it is passable only in summer, and is the only passageway between the Jocko river and the northern end of the Mission range. The creek flows a little south of west, receiving Mud creek near the sand dune previously mentioned, and flowing into the Pend d'Oreille river. It is a large creek, clear of brush, a famous fishing resort. Mud creek rises in the canons near the southern arm of the lake, flows south of west, receives the waters from Ronan Springs, passes the edge of the sand dune, and enters Crow creek a couple of miles from the dune. It is not a large creek, but irrigates several farms. A fair sized stream reaches Crow creek. From the sand dune to the lake is 15 miles. The land is level, and no streams cross it.

ORNITHOLOGY OF MISSION VALLEY.

The country between Crow creek and Post creek is full of pot holes, of varying sizes and depths, containing water all summer. Hundreds of these small ponds may be seen from elevation on the mountains, the larger ones lying near the mountains. These pot holes abound in entomostracan and insect life, prolific in quantity rather than species. Thousands of frogs line the banks all summer, and garter snakes, feeding on the frogs, are numerous, large and fat. In the grass and reed bordered ponds water fowls breed and rear their young. In the fall large numbers of migrant water birds stop at these ponds, making an ideal field for the hunter and sportsman. In July the most abundant water fowl found with young was the American Golden-Eye, **Glaucionetta clangula**, var. **Americana**, taken at several places. A camp of several days was made at Crow creek in July, 1900. Three years previously a camp of several days was made near the same place. In the creek three species of case worms were found. A quart of bivalve shells, **Margaritana margaritifera** were taken in the sandy shoals. Several other species of shells were found, **Planorbis trivolvis, Limnaea palustris**, a **Physa, Polygyra townsendiana**, var. **Ptycophora, Pyramidula solitaria**, and **P. strigosa**, var. **Cooperi**. Dragonflies were not numerous. **Aeschna contsricta** was seen everywhere. **Sympetrum obtrusa** was abundant; indeed, it is the most common dragonfly in western Montana, and is easily captured. Around one of the ponds near the creek **Sympetrum** (Diplax) **madida** was common. They were wary, shy, and hard to catch. Two hours of hard work resulted in only about two dozen. **Lestes unquiculata** was the most abundant. Hundreds could easily have been captured had they been wanted. A few **Amphiagrion saucium** and **Ischnura** were taken, making a total list of Odonata captured on the plain. In the stagnant water many Ostracoda were secured. Butterflies were not abundant. One catch of nearly a hundred Brenthids was very satisfactory. These were nearly always taken on a blue aster. **Colias eurytheme**, brilliant orange, were found in the grassy flats. **Pieris protodice** was not uncommon. A **Grapta** was occasionally seen. Among the shrubbery **Satyrus alope**, var. **olympus** was often seen. A single male **Argynnis leto** was captured. Several **Argynnis aphrodite** were among the captured. A single **Lycaena**, a few skippers, a **Thecla** and a **Chrysophanus**, made the remainder of the list. Except along the creek and around the ponds there is no collecting.

Birds in the valley are interesting, and around the water are abundant. The list of the ornithologist shows 43 species. Many of these are quite abundant. The few days spent here were fully occupied by the ornithologists, and over 60 skins was the result of their earnest work.

These were all prepared in rolled zinc holders to keep their shape until they could dry. In the few wheat fields several flocks of sharp-tailed grouse were flushed. Western meadow larks were everywhere abundant. A few mourning doves, **Zenaida macroura**, were found around the grain fields. Solitary sandpipers, **Totanus solitarius**, were along the streams. In the bushes catbirds, **Galeoscoptes carolinensis**, blackbirds, **Scolecophagus cyanocephalus**, yellow warblers, **Dendroica aestiva**, Audubon's warbler **D. auduboni**, flycatchers and others were always to be seen. In the trees were black-headed grosbeaks, **Habia melanocephala**, and woodpeckers, Lewis', **Melanerpes torquatus**, and Harris', **Dryobates villosus harrisi**. It was a pleasure to sit in camp and listen to the notes of the numerous species of birds. Over twenty were counted the first forenoon in camp, either by sight or by note. The total number seen during the few days at Crow creek is 43. Remembering that the creek forms but a narrow belt of vegetation in the valley, with dry plain and little vegetation on either side, this number is quite large.

GLACIAL ACTION.

Mission valley is undoubtedly glaciated. Between Crow creek and Post creek the valley contains many potholes, depressions in the surface which catch and hold water during the rainy season. At the lower end of the valley, near St. Ignatius Mission, large boulders lie high on the hills, while there are ridges and valleys plainly morainal. The valley and mountain range are worthy of careful study, and will repay the person who makes the study.

The southern end of Mission valley has a much larger moraine than that at the foot of Flathead lake, mentioned in succeeding pages. It extends from the mountains on the east westward as far as Plains on the Northern Pacific. It may extend farther as the writer has not been over the ground. The morainal matter in the vicinity of St. Ignatius makes hills several hundred feet high.* The height of these above this plain has not been determined, but it is certainly more than 500 feet. High up on these hills large boulders have been left stranded. The morainal matter here is badly broken and cut. The hills show plainly the presence of water in former times, beach marks being plainly visible from a long distance.

The entire Mission valley is made from glacial material, with high morainal deposit at both the northern and southern ends. The glacial drift extends many miles westward. It has not been followed, and the character of the soil cannot be given. The Pend d'Oreille river has cut a new channel through this valley, removing the glacial drift to bed rock. Whether this river drained the lake formerly covering Mission valley is for geologists to determine.

No doubt some of this material came from the Mission range. The mass of it could not have done so. The Mission range extends north and south. The canyons opening into the valley open westward. In front of each of the larger canyons is a small morainal dam, extending generally from north to south, or parallel with the range. The large moraines previously mentioned extend from east to west, at right angles to the range. They are many miles in extent, much larger than any drift from canyons. A careful examination of the region north and west of Flathead lake will no doubt reveal glacial material on a large scale. From the trend of the mountain chains in that section of the state it will be interesting to trace this drift to its source. It is quite probable that this will be in the Kootenai mountains in the northern part of the state, with additions from the Swan and Mission ranges.

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* It is possible the morainal deposit may be on a foothill, covering the rock.

BOTANY OF MISSION VALLEY.

Collecting in the Mission valley is confined to the spring of the year. When the June rains fall almost daily the valley is a bed of flowers from end to end and from mountains on the east to mountains on the west. The vegetation is very characteristic. A few species of conspicuous flowers hold sway, and an examination of any spot after hours of walk will reveal almost identically the same flora over the entire distance. During the wet spring months the valley is a fairy land of flowers. But later when the rains cease the vegetation withers. The lupines are visible only by the stumps of stems. **Balsamorrhiza sagittata**, with its big and thick leaves, is a conspicuous feature. The leaves dry on the stem, and stand so thick in places that to pass through makes noise enough to be heard a long distance. **Achillea** holds its green color well, but it succumbs to the heat, and withers on the ground. Wild Cranesbill is another abundant flower, and it with the others dies. The thousands of heads of cattle and horses nip the grass to the roots, and the former beautiful valley looks brown, bleak and bare.

The ride across Mission valley in early June, 1901, was delightful. Everything was at its best. Copious rains caused the vegetation to be profuse. While the number of species was not large the abundance of plants of a species was very great. Comment was frequently made on the beauty and abundance of the flora. Two months later the valley presented a brown, sun-scorched, and bleak appearance.

In 1902 the trip across the valley was made early in July. The vegetation was waning, but was still very beautiful. Most conspicuous were the large areas covered with Clarkia, **Clarkia pulchella,** Pursh. This beautiful flower will forever keep in memory of botanical students the name of its illustrious discoverer. The flower is a beautiful and delicate purple. The plant grows from six inches to two feet high, often spreading widely, though usually small, slender stalked, with a profusion of nodding flowers. It grows on the high and dry slopes, rarely appearing above 4,000 feet. It is a conspicuous feature of the landscape in western Montana during the summer. Often it is so abundant that the purple patches may be seen for miles. On the trip mentioned the **Clarkia** was just at its best. Everywhere in the valley it could be seen in greater or less abundance and profusion. Here was a beautiful stretch covering several acres, growing on a gentle southern slope. Yonder were smaller straggling patches, lending a delicacy of color to the mass of white **Achillea**, blue **Lupinus** and yellow **Balsamorrhiza**. In whichever direction the eye was turned the **Clarkia** might instantly be distinguished from the other vegetation. In this open valley it is at its best. It is a flower of the prairie or open hillside, rarely taken in woods, and then only in open places.

The western milfoil, **Achillea millefolium**, L., is also a conspicuous flower of the landscape. Everywhere in open prairies it grows in great abundance, although not in such great masses as the **Clarkia.** It is everywhere common, but grows among the other vegetation without apparently monopolizing the soil. In the Mission valley the milfoil thrives luxuriantly. In the early spring its clusters of dissected leaves lends a charm of color. Later the stem ascends, in midsummer reaching maturity. Its abundance of white composite flowers, scattered among the blue **Lupinus**, purple **Clarkia**, red **Geranium** and yellow **Balsamorrhiza**, is easily recognized and is very conspicuous. Later, in August and September, the plant withers and dries on the stem; the leaves dry and become a dull brown; the flower stalks and flowers have fulfilled their mission, and the whole plant is dead and withered.

Another flower of the plain and open hillside is the composite **Balsamorrhiza sagittata**, Nutt. This plant has large, thick, auriculated leaves, growing in clusters from thick rootstalks. The flower heads grow singly on branchless stalks a foot or two high. The plants do not grow tall. The large leaves spread out in every direction, casting shade over the smaller vegetation. Not only does the shade retard the growth of competitors, but the large rootstalks monoplize the soil. The flowerstalks are numerous, each with a large, yellow, and conspicuous head. The plant grows in masses. Its best season is in June. It begins to blossom in early May, continuing until late in July. In August the leaves wither on their stems, rattling more with the movement of an animal than dried corn stalks. **Balsamorrhiza** grows abundantly on the dry and level plains. It is a xerophytic plant. It ascends the dry and open hillsides, and the large areas of yellow flowers may be detected miles away. Occasionally it seems to get into low and swampy meadows, where it struggles for an existence. It is sometimes seen in dense timber, often in open timber, but thrives best on open plain or hillside. It grows abundantly at all altitudes in the western part of the state up to 6,000, more sparingly for perhaps another thousand. In the Mission valley it has its best growth on the slopes nearer the mountains, and in the open woods and treeless hillsides. In the Mission range a species of **Lupinus** is as conspicuous as any of the flowers previously mentioned, and fully as abundant. Early in the spring its palmately compound leaves make their appearance, easily recognized. In May it has begun to bloom, the flowers continuing until late in July, when the last unfold. At the time of our passage, July 11, the plants had passed their best, save an occasional stalk which was covered with deep blue flowers, causing exclamations of pleasure and delight from the botanists of the party. Like the plants previously mentioned, this lupine thrives in the open plains or hillsides, but is almost as abundant on partially wooded slopes. Mountains from 2,000 to 3,000 feet high are in spring time clothed from foot to summit with its luxuriant growth, its deep blue making a charming mixture with the sombre green of the yellow pine, red fir, or the brighter green of the tamarack and balsam. Unlike the **Clarkia,** and like **Achillea,** it is scattered everywhere, seldom occupying ground to the exclusion of other plants.

Here and there among the vegettion the traveler sees another composite, taller than the **Balsamorrhiza,** with yellow center and dark brown ligulate border, much like the "bright-eyed Susan" of the east. This is **Rudbekia hirta,** a flower well worth cultivation for ornament. It is not so abundant as the others mentioned, but is strikingly conspicuus because of the decided contrast it makes with the remainder of the vegetation. Like the others it is xerophytic, selecting soil high and dry, lending a special charm by its beautiful flowers. Montana horticulturists should not forget it in selecting native flowers for ornament.

Less noticeable, but equally abundant along the way is a small composite resembling the eastern daisy or white weed. The flowers vary from a delicate pink to pure white. The plant is very abundant.

Less abundant than those before mentioned, but growing profusely wherever the soil is damp, along the edges of the glacial pot holes, on the banks of streams, around springs, in wet places on the mountain side or in the valley, the wild cranesbill, probably **Geranium caespitosum,** James, may always be found. Its general appearance and color are not so pronounced as those just discussed, but it is a well known plant, abundant, with luxuriant growth when it occurs.

Occasionally a thistle was to be seen, its flowers dull white or faint cream colored, its leaves presenting a bleached appearance, entirely unlike the delicate colors of the eastern pasture thistle. Its long and numerous spines give it good protection, and when it is seen the plant appears thrifty. But it is nowhere abundant. Here and there an occasional stem may be seen, but great patches of thistles such as are common in the middle and eastern states are unknown.

In the damp places along the road, of infrequent occurrence in the Mission valley, an occasional tall mallow, probably **Malvastrum numoanum** Gray, with delicate rose colored flowers crowding its upright stem, towers above the other foliage of the valley. These are stragglers. The plant thrives in the wet thickets and open banks of streams, where it is often very abundant. Flowers are often as conspicuous because of rare occurrence as of abundance. The traveler cannot fail to see the **Clarkia.** Its attention is forced because of its abundance. The same may be said of **Balsamorrhiza, Lupinus** and **Rudbekia.** But in the Mission valley, where the vegetation is low, where the eye may see for miles, a tall stem covered with large delicate rose colored flowers is at once observed and noticed.

Wild dandelions thrive luxuriantly at places in the valley. Cinquefoil or five-finger is everywhere. Yellow composites with small heads show here and there. These, with the plants previously discussed, make up the greater portion of the vegetation over the valley. But the botanist who seeks the smaller and rarer forms will be able in a short time to fill his vasculum, each watered pot hole containing a large number which must be sought to be seen and which only the collector is likely to find.

About half way across the valley the traveller passes the sand dune where free sand shifts from year to year, slowly moving eastward. On the sandy ridge but one plant has a foothold, i. e., **Symphoricarpus racemosus**, Michx., the snowberry. The sand buries this deeper and deeper each year, but it grows new shoots above, while the roots below are deep enough to obtain sufficient moisture.

In the early spring hundreds of small ponds in glacial potholes are filled with water. Around these collect various forms of animal life. Later these all dry up but a few of the larger ones, around which life is fairly abundant. A few rods from the creeks, on either side, and collecting in summer or autumn ceases. A few forms of life may be found, however. Hiding in the withered clumps of **Balsamorrhiza, Lupine** or Cranesbill are hundreds of the big, black, and rapacious Rocky Mountain crickets. Over the dry duffalo range they hold sway with the departing king of the plains. When startled from their hiding place they give a series of loud, shill, and startling noises, accompanied by vigorous bodily movements, which invariably startle the collector. A few grasshoppers live in the same region. Now and then a battered and frazzled butterfly, **Pieris protodice** or an **Argynnis**, flutters feebly past. In the buffalo range and over most of the valley there are no trees save along the water courses. The sparrow hawk is frequently seen on the wing or perched upon a rock. Other and larger raptores circle in the air or are busy at the dead carcasses on the plain. Not infrequently a coyote is observed skulking near the herds of cattle, and even bears come down from the mountain sides into the timber along the creeks.

Collecting has been done at various places in the reservation and along the shore of the lake, in spring, summer and late fall. The reservation and the lake are crossed annually in going to and from the Station. Plate XLVI shows the most of the lower end of the lake, viewed from the moraine. The absence of timber will be specially noted. The swamp area, in which is the greatest amount of life, is to the right, extending to the mountains, not shown in the plate. On the left may be seen the outlet, the Pend d'Oreille river, which is about a mile wide, crossed by an old fashioned ferry, propelled by oars made from pine poles. The chain of islands which almost cuts the lake in two is plainly visible, the main lake lying beyond the islands. During summer the water in the visible part varies from 20 feet in depth to a shallow swamp. The postoffice, Polson, on the lake-river bank, may be located by following the road. Boats plying across the lake land at this place. The river is not navigable.

The Buffalo Herd.

So much scientific interest centers in the fast disappearing and almost extinct buffalo that a few words on the herd now roaming the plains in the Mission valley may not be out of place.

The buffalo herd ranges in the Mission valley, west of the main travelled road. They may be on either side or both sides of the Pend d'Oreille river. West from Stinger's ranch, twelve miles from the lake, is a large butte, rising from the plain. Near this some of the buffalo are quite likely to be found. Leaving the road at or near Stinger's the visitor may see the herd with a couple of hours travel. It is not likely the entire herd may be seen in one place.

Eighteen years ago, in 1884, Charles Allard and Michel Pablo bought of an Indian named Samuel ten head of buffalo, which the Indian brought from east of the Rocky Mountains. From "Buffalo" Jones, in Nebraska, they purchased 44 head, 18 of which were graded stock. From this beginning of 36 full blooded and 18 graded animals the present herd has descended.

At the present writing, February, 1902, there are on the reserve 220 full blooded and 65 graded animals. During the past year there have been sold nearly one hundred animals. In the years past others have been sold, but the number is not determined.

Twenty-seven head were sold to Conrad of Kalispell, and are now cared for on Conrad's ranch. Between 40 and 50 are said to have been sold to a company, the majority to stay on the Reservation, the others to be used in the show business. Several were sold to Iowa parties.*

In 1901, 65 calves were added to the herd. About half are reported to be males. Many of the males are castrated. About half the cows are said to have calves each year. The cows do not have calves until they are four or five years of age. It is claimed that the fertility of the herd is not decreasing. A portion of the calves die or are killed, about the same proportion as for ordinary cattle on the range.

A calf not over 30 seconds born was upon its feet, and not over 20 minutes old showed fight, as stated by Joseph Allard, who owned it.

Half-breed cows are fertile, either with buffalo or cattle. Half-breed bulls have not been tried and are not reported.

The stags show many differences in build from bulls. The principal difference to be noticed is in the horns, which are longer, probably larger, standing out farther from the head.

Twenty-seven of these animals were recently taken to Plains in order that two might be selected from the number. Five men were driving the animals, and even then a half dozen got away. They would not follow the road, but went up and down hills as they pleased. They are sure footed, quick and nimble. The cows are always on the alert to see an opportunity to escape, and move very quickly. After escaping they immediately return to the herd.

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* 25 were sold in the fall of 1902 for use in the Yellowstone Park. In October the guardian of the minor children requested permission of the court to sell 60.

The animals paid little attention to barb-wire fences, and went through on many occasions. After they were put into the high fenced corral at the stockyards they mashed down the gate, several escaping.

In crossing a river with ice it is necessary to make a good trail with horses, so the tracks may be visible, otherwise they will not cross. They look first at the near side, then at the far side, then dash across. An old bull will probably lead, when all will follow. They are sure footed, and take ice as easily as a shod horse. They plunge into water without hesitation when separated from the herd and are returning and swim easily and rapidly. The cows are much harder to handle than the bulls.

They usually range in two main herds, but in the winter of 1901, they were in three herds. These are further split up into small bands of from a few to several dozen.

The range of the buffalo herd is along the Pend d'Oreille river, in the Flathead Indian reserve. Occasionally they wander into the cultivated fields of the Indians and squaw men. They range over a territory 8 to 10 miles long and about as wide. With them are many herds of cattle and horses. It takes a practiced eye to determine whether a speck on the horizon is a herd of buffalo, of cattle or of horses.

A herder is kept with the animals continually. He knows where they are, keeps note of the increase, looks after the calves and the herd generally, much more closely than for domestic cattle.

Every Chirstmas season a few of the largest and finest bulls are sold to the butchers of the adjacent large towns, Kalispell, Missoula, Butte and Helena. These are sold over the counter as meat, while the heads are retained as mounts. Considering the few remaining animals in the world this seems a public calamity. But as the herd is owned by private individuals to whom appeals for the public interest and for science are of no avail, and who by law may do as they please with their own, the business is likely to continue. The price put upon the animals when sought by eastern people for parks and zoological gardens is so high that sales are almost out of the question, since the freight haul is long, the tariff high, and danger of death before the end of the trip not improbable. It is too bad some means cannot be devised to save the lives of the large fine bulls slain annually. It is claimed, however, that most of the animals thus killed are stags.

The steps one must take to see the herd are about as follows: One may either ride on horseback or take a rig, preferably a buggy. If he is wise he will also secure the services of an Indian as guide, to locate the herd and "round up" the smaller herds into one large bunch. There is no telling where the herd will be on the range. As a consequence the Indian starts out toward the high butte near which they are most frequently found. When a herd is sighted the guide will ride toward it until he can determine whether they are buffaloes or some other animals. In the latter case he takes another direction until another herd is sighted. It not infrequently happens that one travels for hours before seeing the herd in the distance. In one instance the writer with a party was in the immediate vicinity, and it required most of the day to see the herd and return to camp. Uusually one can see the herd with little difficulty, and it is well worth a day's work and the slight expense.

The animals go in small squads of from two or three to fifty. The Indian guide races his cayuse after a squad, coming up in the direction he wishes them to go. He will ride leisurely until he reaches the position that suits him, will then turn toward the squad, spur his cayuse to full speed, shriek like a demon, and fire his six shooter again and again. The squad is run in the direction of a larger squad. When they are joined he goes in search of others and repeats the same performance, until his cayuse will be panting and reeking with perspiration. Occasionally he will approach the visitor and stop at a respectful distance, sitting idly in his saddle. If the visitor says nothing no more will be brought up. If the visitor points to others or asks for more they are likely to be brought.

One may go within 20 to 30 yards of the animals. If closer approach is made they will slowly move off. If the pursuit is continued they will hasten the gait to a trot, then to a gallop, and finally run at full speed with lowered head and straight tail, bellowing every few jumps.

The guides are very positive the beasts will do harm to one on foot. There are several bad animals in the herd, and most of them will "stand pat," as expressed by one of the owners.

The writer has tried to go among them on foot, for photographic purposes, but they have invariably decamped. The first time they were viewed there were over 200 in the herd brought together. They were continually bellowing in their low, deep and rumbling gurgle. They would keep pawing the earth and stirring clouds of dust with their hoofs. The large masses of unshed hair in spots was a decided contrast to the sleek places where the hair was new. It is well known they shed in masses of hair. The young calves in color resembled Jerseys. The old bulls were noble looking fellows and looked large. Not a tree is on their range, save a few scraggy pines on the rocky buttes or along the river. The entire herd may be in a coulee but a few rods away and be invisible. It certainly is an unusual sight to see such a large herd on such a range; while the guide with his wide sombrero and leather chaps, his heels adorned with long clanking spurs, lends a charm that is more than passing. He eyes them constantly, answering questions with one of three answers, "yes," "no," "I don't know." Diligent inquiry may bring information, but it will not be volunteered by the guide.

The inspection over the guide gives a whoop, fires his six shooter, spurs his horse at them, follows for thirty or forty rods, shrieking, shooting and spurring his horse on, when it is over. They soon scatter, and are mostly out of sight. They always appear restless, and are seldom standing quietly, as cattle or horses often stand.

To make a visit to the herd is not difficult, and any number of photographs may be secured.

The country over which they roam is near the Pend d'Oreille river. The soil is sandy, held from blowing by vegetation. There are numerous coulees and a few high buttes. To the east the Mission range, snow-capped in winter and clothed in dark green during summer, makes an imposing view. Occasionally in winter, when the river freezes, the herd crosses the river and give much trouble.

In the large bay of Flathead lake extending west from the main body of water is a large island, named Wild Horse Island. Its location may be seen by consulting Plate XXXVI. Several years ago about 75 half-breed buffaloes and four full blooded bulls were placed on this island and left to roam. The island is several miles long and not quite as great in width. It is well timbered, and rises several hundred feet above the lake. The writer has not been on the island, but has been around it on the water. No one lives on it. Rarely is it visited, even by Indians. It is entirely within the Flathead Indian Reservation.

The buffaloes staid on the island for a couple of years, but did not like it. They began swimming to the mainland, a mile and half away, continuing thus until but a few were left on the island, when they were removed.

This short record shows what can be done by private enterprises, and that the work of the Indian. In twenty years a hord of 36 has increased to more than 350, or ten times the original number, with no record of the many sales that have been made during most of the time. In 20 years the number of calves is given per year at 65, more than double the original number. The range on which the herd is kept certainly does not exceed 70 to 100 square miles, and they could no doubt be kept on a much smaller range than this.

There is this noticeable difference between the Allard-Pablo herd on the Flathead Indian reservation and the herd in Yellowstone Park, to which so much attention has been directed, and which has done so much toward forming an opinion in the minds of men adversely to further attempts to save to the world a herd of these noble animals. The Allard-Pablo herd has a man with it constantly. The animals are therefore accustomed to man, and are not alarmed at his approach. The Park herd were rarely seen by man, and were not carefully looked after. The Park herd were placed at a high altitude, over 7,000 feet, where snows were deep, winters long and severe, and where it was very difficult, perhaps impossible, to give them aid in case of scarcity of food. The Allard-Pablo herd has a range at altitude below 3,000 feet, where deep snows do not occur, and where poachers cannot molest without fear of discovery. Moreover, hay or grain may be taken to the herd in a few hours in case of necessity. While they range in a treeless valley, they have in the range coulees, morainal depressions, river and creek banks, which offer shelter. Several high buttes offer protection from the wind, while the river, creeks and ponds supply abundance of water.

From a careful study of the facts it will become apparent that Congress should not cease in its efforts to save the buffalo from extinction. An appropriation of $8,000 will purchase 25 cows and a dozen bulls. If purchased from several different herds there is little danger from inbreeding. This is as large a herd as Allard and Pablo had in the beginning. With the same care exercised over this herd in 20 years the increase from 25 cows and 12 bulls should make the herd number between 400 and

500. Now, there are large tracts of land leased annually for small sums to large cattle dealers. There are large tracts in Indian reservations which can be utilized for some such purpose more legitimately than to lease to cattle men for stock. If a tract of land containing from 50 to 100 square miles were set apart for this particular use, with an appropriation at the beginning of $15,000, and an annual appropriation of $5,000, there certainly should be no difficulty whatever in developing a herd from a small beginning to one that would be a credit to the nation.

The government and care of the herd should be placed under the jurisdiction of the Biological Survey of the Department of Agriculture. The men in the Survey are keenly alive to the importance of an attempt to save the buffalo from extinctin, and may be relied on to look after the animals as carefully as they are looked after in any zoological park.

It is hardly to be expected that the animals will thrive in the Yellowstone Park, where the winters are long and severe, the summers short and concentrated, and where protection is likewise afforded to the wild animals which prey upon the calves. The buffalo, unlike the deer and elk, seems to remain in a limited territory. If they are to thrive and multiply, they must be looked after and cared for. With a range in Montana, Idaho, Arizona or New Mexico as mentioned above, with a small herd under care of the Biological Survey of the Gvernment, a small appropriation will, with proper handling, produce a large herd in fifteen or twenty years.

It is to be hoped that the recent small appropriation made by congress for the preservation of the buffalo will be sufficient to protect it from extinction. It is doubtful, however, whether they will ever thrive in the Yellowstone Park without much care in the winter. A lower altitude, with less snow and longer summer, similar to that of the Flathead Indian Reservation, will insure the safety of the herd with small amount of attention and expense.

Flathead Lake.

The following report of the lake was prepared by Fred. D. Smith, formerly Professor of Chemistry and Geology at the University of Montana, now mining engineer at Sumpter, Oregon. The paper was prepared while he was connected with the University, after he had made an extended trip around the lake and over a large portion of the country adjacent.

"The lake occupies the lower portions of an immense valley that reaches from a low range of hills along the Jocko river northward across the British Columbia line, and which has a total length of over 100 miles. Tobacco Plains on the north are a part of this valley though separated from Mission valley by a low range of hills. This larger valley may be considered made up of three smaller ones, viz: Mission, south of Flathead Lake; Flathead, north of the lake, and Tobacco Plains still farther north.

Mission valley has a general elevation of from 100 to 250 feet above the lake level and a length of about 35 miles north and south with a width of from 5 to 10 miles. Flathead valley has a slight elevation of from 20 to 50 feet above the lake and is much more regular in its surface contour and its width. Its length is about 40 miles and the width 8 to 10 miles. These two valleys are the more important in this discussion as each illustrates a geological process bearing on the history of the lake. (The lower portion of Flathead valley may be studied from Plate XXXVII.)

The present lake is the remnant of the much larger lake that occupied these valleys in Tertiary times, as shown by the lake beds in both valleys as well as in the valley through which the Jocko river flows. As yet little, if any, investigating for vertebrate fossils has been done in these beds though it is probable that they are of the same age as those of Flint creek and Madison valley studied by E. Douglass.

Mission valley and the lake are bordered on the eastern side by the Mission mountains, a range which rises abruptly from the plains to great heights. These mountains, with a very steep western slope, have their summit within relatively short distances from the valley and consequently the streams therefrom are neither large nor of great volume in discharge. On the other hand the eastern slopes of the mountains are long and gradual, thus furnishing a larger drainage area to the Swan river and Blackfoot tributaries which receive the waters. This range, as such, appears to terminate at a point near the upper end of the lake where the Swan river, changing its course from northward to west and south westward, flows into Flathead lake. Another range, the Swan range of the Kootenais, some 12 miles to the N. E. continues to be the border of Flathead valley in a manner similar to that of Mission range just explained.

The history of these valleys or of the one larger valley, when all are considered as one, is very interesting. The Mission mountain range was caused by a fault, having a general direction of north and south, with a stronger throw on the southern end. This resulted in a much larger slip on the southern end of the range than on the northern. In fact the slight slip on the north together with the erosion by weathering and valley glaciers has resulted in a complete termination of this range, per se, near the University of Montana Biological Station as noted above. The slip must have been several thousand feet at the southern end as the peaks near the St. Ignatius mission are 7,000 feet higher than the plain below. The weathering following the elevation of this range has left the escarpment in jagged and precipitous cliffs making the range one marked by most picturesque scenery.

With the most superficial study only, it is suggested that the range noted above, the Kootenais, N. E. of the Mission range and forming the boundary of Flathead valley, was probably formed by a similar fault. The range of foothills which forms an irregular boundary of the Mission valley and of Flathead lake on the west, reaches westward to a considerable size and shows the strata once continuus with those of the Mission range. They were evidently depressed coincident with the tilting of the Mission which movements, together with the erosion in the trench like valley formed, brought about the long valley extending 100 miles north and south.

Such a valley likewise is the Bitter Root valley, though the peculiar feature of this larger valley under discussion is that while the other valleys of similar history in the state show plainly by their drainage that erosion by streams and rivers has played an important part in the cutting and enlarging of the depression along the fault plane, this one by its peculiar termination at the Jocko hills on the south and by its entire lack of evidences of stream courses from Flathead lake to the south end gives indications of a different history. More detailed study may show that the valley was once occupied by a large stream, or that the drainage, unlike that of to-day, was to the northward instead of southward.

The Jocko hills may have been faulted or raised after the valley erosion had been finished. I have never been able to find any record of excavations in the valley bottoms by which could be learned the depth of the soil and gravel to the rock.

It has been noted above that the Mission valley has a general elevation of from 100 to 250 feet above the lake while the Flathead valley is much more regular in its surface and is but slightly elevated above the lake. These two valleys are of different history in so far as the bottoms are concerned.

Flathead valley plains show clearly that the soil is made almost entirely of sediments deposited in the still waters of the lake. This accounts for the level character of the plains. Little if any glacial deposit has been formed in this valley. Some is found in the rounded hills near the mouth of Swan river and along the eastern border of the valley below Kalispell. These are undoubtedly closely connected with the glacier deposits found nearer Swan river valley. The lake which filled the valley ecrtainly much higher than at present evidently receded rapidly as I have been unable to find any bench marks or terraces on the hillsides. However it apparently receded more slowly after it had reached the level of the Flathead valley sediments as several old stream courses are plainly discernible between the town of Kalispell and the lake.

The plains of the Mission valley have a much rougher and more irregular surface due to the moraines and other glacial debris deposited over much of the valley. The long hill extending diagonally across the valley directly at the foot of the lake is clearly glacial drift as shown by the irreguarly distributed clay, boulders, rounded pebbles, etc. The form of this suggests that it may be classed as a drumlin.

Along the eastern side of the valley are seen many rounded knolls enclosing small marshes and ponds which are all clearly of morainal origin. The small ponds found scattered over the entire valley which contain water most of the summer are probably formed by the depressions in the surface due to glacial deposits. These are plainly shown in Plate XXXIII. Small glaciers undoubtedly flowed from the Mission mountains along its entire length but these deposits must have come from a very much larger glacier, probably from one which came down from the north throughout the whole valley.

The lake in its higher elevations probably had its outlet in a western direction as shown by the old stream course to the westward of the large bay behind the large islands. A stream course near the town of Dayton leading southwestward down the valley of the Little Bitter Root is very plainly discernible.

When the lake reached its present level it found its outlet across the lake beds alluded to above, and through the moraines down its present course, the Pend d'Oreille river. This is plainly shown by the high cliffs of clay and other sediments that still retain their perpendicular sides along the canyon of this river. The increased head of the water in the lake above and the canyon cut below furnished the tools for the outflow to cut its canyon rapidly and the beautiful Pend d'Oreille rapids near the lake at Polson are the result. (These rapids are shown in Plate XLV.)

Flathead lake now forms but one element in the drainage system of the upper valley and the territory beyond the Mission and Kootenai ranges. The entire drainage from this section of the state flows into the lake through two rivers, viz., the Swan and Flathead rivers. The latter is made up of three large rivers known severally as the North, South and Middle Forks. These three streams by their confluence above Kalispell form the Flathead river. This river is very interesting in itself as from its fall and other characteristics it shows itself to be but an arm of the lake. When the lake receded to near its present level, the drainage from the north and northeast flowed across the sediments cutting an irregular channel, meandering across the plains until sufficient fall of the lake level was reached to allow it to cut enough channel to hold the stream. At present it winds its circuitous path across the plains and has a total length of about 35 miles while the distance as measured in a straight line from the forks above is but 15 miles. In general its width is from 300 to 800 feet, and its depth is in some places 75 feet. On account of the sluggish nature of the current of this river the erosion of the banks is slight except on the sharp curves, while the deposition in the bottom of the river and at its mouth is very rapid.

The northern end of the lake into which all of the drainage is poured is apparently composed of sediments deposited in the manner mentioned as a large delta. The course of the river is plainly traced into the lake for some distance by the delta thus formed, which for a distance of from one-fourth to one-half mile from the shore is sufficiently high to be covered by vegetation and in some places by shrubbery. Beneath the surface of the water the formation is discernible for a long distance farther into the lake. Consult Plate XXXVII.

The opportunities for interesting and valuable geological study in connection with the Station are therefore apparent at first sight. Whether in connection with a study of the bottom of the present lake or as a separate study of the glacial deposits along the valley north to the boundary the study will be both of value and of interest. To students who have had some general work in geological study the field is a most promising one. A study of the valley from the upper end of the lake northward with particular reference to its relation to the older lake and river will certainly afford work for many students. This portion may be a delta itself or only the sediment of quieter waters. Beyond all of these questions a study of the territory within greater distances, especially north of Kalispell and around the divide between Swan river and the Big Blackfoot tributaries, may bring out information that will throw great light on the history of many other portions of old topography of the western slope of the Rocky mountains. The Mission mountains will prove to be an interesting study from the petrographical standpoint as will also the Kootenais. In view of the recent developments in the study of the Miocene Lake beds of Montana it would seem that Flathead lake offers a great field of study as both ancient and recent beds can be studied at once."

In addition to the above notes by Mr. Smith may be given the following:

The outlet is called by some Pend d'Oreille river, by others Flathead river. Some consider Flathead river to extend from its source to the lake, then from the lake to the Missoula river. Others give the name Pend d'Oreille to the stream from Flathead lake to the Missoula river. The river formed by the junction of the Missoula and Pend d'Oreille is called Clarke's Fork of the Columbia.

The present outlet of Flathead lake is of recent origin. The river for several miles near the lake is swift and rocky, a series of rapids alternating with more quiet water. About a mile from the lake there is a large bank of clay through which the river has cut. The clay is continuous with and apparently a part of the moraine mentioned. At the river bank it has been cut and eroded by the wind and rain. The bank is abrupt and steep, the clay clinging together so as to form cliffs, some ending in sharp pinnacles. Below the clay is the bed rock, similar to that found at different places around the lake. The river has done some cutting through the solid rock bed, but not much. At one place the channel is partially dammed by a large rock in the center of the river. Above and below this place the river is a beautiful sheet of foam, with several small falls. It is as beautiful a rapid as one usually sees. In my estimation it is superior to the rapid above the first falls in the Yellowstone. Plate XLV shows the rapids as seen from the hillside some two hundred feet above the water. This is a great fishing resort for the Indians on the reservation, and one seldom visits the place without seeing several tepees on the bank some place near. The osprey is as industrious as the Indian, and is seldom absent from the scene when one visits the rapids.

The moraine at the lower end of the lake is worthy of more extended notice. Between it and the lake is a level plain. At the western end, where the plain is widest, it separates the moraine from the lake by a distance of about two miles. Eastward the hills come almost to the water's edge, separated only by a narrow strip of level land.

This level plain shows clearly two terraces, with evidences of a third higher upon the hillside. The terraces correspond with similar terraces at the northern end. Here one is beautifully shown at Sliter's, near the Station.

The lake has therefore had two, possibly three levels other than that at present.

The moraine is 450 feet above the level of the lake, at the place where the wagon road crosses near Polson. There are probably several places higher than this. The railroad survey crosses the moraine about midway between the Pend d'Oreille river and the mountains. Their readings show the height at the river to be 84 feet less than that at the place selected for passage. The engineers preferred the higher passage because the lower necessitatd doubling back in order to get down on the southern side.

The wagon road winds back and forth in its passage over. The lake is invisible until the traveler reaches the crest of the hill, when it comes suddenly before him in all its beauty. The view of the lake proper is obscured by the islands and peninsula, which practically cut the lake in two. The view of the lake from any other point is better than that from the lower end.

The banks of the lake do not afford as much shelter for invertebrate life as would at first seem apparent. The southern third, cut off by the islands, is shallow, nowhere of greater depth than twenty feet. The eastern part of this bay, formed by the peninsula projecting from the Mission mountains, is very marshy, with muddy bottom. Rushes and weeds grow abundantly, offering an excellent harbor for smaller life. This is the largest marshy region around the lake. Between the mouth of Flathead river and the mouth of Swan river, along the northern shore, is another marsh in the spring, of peculiar nature. At the water's edge is an embankment of a more or less rocky nature. North of this embankment is a shallow marsh, about two miles long and a quarter to a half mile wide. When the lake rises, as it does in the spring, from ten to twelve feet, the water flows over the embankment, and into the low land. As the lake recedes the imprisoned waters cannot escape, and offer a fine breeding place for mosquitoes for some time, until the waters evaporate or filter through the soil to the lake region. Most of the remaining banks are rocky, precipitous at the water's edge, with or without a gravelly beach. The bottom generally is reported to be rocky, with little mud. This report comes from the captain of the boat Klondyke, who has anchored all over the lake; his experience on the lake extends over a period of many years. Compared with the size of the lake the swampy country is small. From this it would appear that the breeding grounds for most of the fish must be in regions distant from the lake, causing long migration periods. This is made more apparent from the fact that fish are rarely caught any place in the lake except at or near the streams entering the lake, or at the outlet.

Flathead lake is popularly supposed to be very deep. I was told it was 1,500 feet deep in places. During the summer of 1899 some twenty soundings were made in the lake and rivers. The greatest depth obtained was 280 feet. The location of this may be found by referring to the map. Eugene Hodge, captain of the Klondyke, states that nowhere is the water deeper than this sounding.

McGovern Bay, on the northern end of the lake, is about seventy feet at the deepest. Flathead river has filled in a large amount of sediment. East of the mouth of Flathead river the drop in depth is sudden from the river bar. The deepest portion of the lake is off shore on the east side, next the Mission mountains. In high water a great deal of land at both ends of the lake is covered. If the depth of the lake should be lessened by ten feet, thousands of acres at the lower end would be uncovered. The annual rise and fall of the lake is from ten to fourteen feet, but it has risen as much as nineteen feet in a season. The lake acts as a huge reservoir for water storage, but overflows much land almost every year when it is at the highest. The amount of water flowing into the lake and out of the lake annually has not as yet been determined.

Life in Flathead is scarce. Although some species are taken in great abundance, the cold clear waters, with rocky bottom and banks and with few marshes, make life scarce as compared with similar bodies of water located in warmer climates at lower altitudes.

It is impossible to present the results on Entomostracan work in this paper. These results will be prepared separately. The work of collecting has extended over four seasons, and many data have accumulated.

During the summer of 1899 collections were made on various portions of the lake. Report of this work has been made. In 1900, colcollections were made by Prof. L. A. Yontz, then of Montana Wes. University, now at Lawrence University. In 1901, Maurice Ricker, of Burlington, Iowa, carried on the investigations. These studies have been made in but two months of the year, July and August. It is important that collections be made during other months of the year, in order that seasonal changes may be studied.

In 1902, collections were made during the months of July and August by Maurice Ricker and the writer. Pumpings were made almost daily, as the weather would permit. Specimens were taken at depths from surface to 130 feet.

Collecting around shore is confined to the country adjacent to either end of the lake. On the eastern bank the Mission mountains come down to the water's edge, with a few benches at different places. There are no large streams entering the lake from the mountains on the east. In the 30 or 35 miles of bank there are only four or five small streams of water, any one of which one might step across. These lead down through deep and steep canyons, with dense underbrush, fallen logs and boulders. Botanical collecting is good. Insects are not abundant. The birds have been noted. The shells have been pretty well worked up, as far as species are concerned.

On the west side there are two large creeks, Dayton creek and Big creek. The former enters the large arm of the bay. Lake Ronan, which it drains, has not yet been visited. Indeed, no collecting has been done on the west bank of the lake. Big creek is near the northern end of the lake, flowing into McGovern Bay. At the mouth of the creek there is some low and marshy land, small in extent. The lake a few feet off shore is deep. The bay near its center is seventy feet deep.

On the west the mountains come down to the water's edge as they do on the east, though they are not so abrupt nor so high. The reservation line passes north of the wide bay at the lower end, thus placing much of the Dayton creek low land within the reservation. Settlers have taken up land along the lake, on both sides without the reservation lines, and the proximity to the lake makes this land very desirable for fruit raising. The region about Big creek has not been examined. No explorations have been made in the mountains west of the lake.

As has been stated, the water of the lake is received through the Flathead and Swan rivers. The annual rise of the lake in 1900 was 8.3 feet. That year was one of low water. It is claimed by those in a position to know that the water has risen as much as seventeen feet during a season. Since the lake has an estimated length of about 30 miles, which will for convenience be made 25 miles, and an average width of from 8 to 10 miles, no doubt more than this, it will be seen that the water held back by this lake in storage is sufficient to cover an area of from 200 to 300 square miles to a depth of from 8 to 17 feet. Swan lake, a few miles from Flathead lake holds the waters of Swan river in similar manner from passing to Flathead lake.

The amount of water flowing into Flathead lake, or out of it, has not been determined. In 1899, two gauges were established on the lake by the U. S. Government, one at the upper and one at the lower end. These were continued for a little over a year and were discontinued for lack of funds. But one measurement has been made of Swan river, none of Flathead.

The air currents of the lake are numerous, and worthy of extended study. Rarely is the water perfectly calm. It has been seen, however, so still that shore objects were beautifully mirrored. The mountains on such occasions show up grandly in the reflection. A ride across the lake at such time is rare, but it is one never to be forgotten. In the evening when much of the pumping was made for entomostraca there were many occasions when the water was comparatively quiet. Usually, however, a breeze was blowing.

During the summer the wind on the lake is from the south or southwest, the prevailing direction of the region. The general or prevailing winds in the summer are as follows: In the morning there is a gentle breeze down the lake from the north. Soon this dies away, and the wind springs up from the south, increasing until early in the afternoon. Toward evening the lake becomes quiet. About dusk a light breeze blows out on the lake from the mountains. At the laboratory the evening lake breeze is from the east. We have often watched the ripples moving across the water toward our boat, coming from the land, as we were at work with the pump. The mountains cool quickly, the cool air flowing down the sides and across both the valley and lake. Similar phenomena have been noticed on all the lakes of the region.

Opposite Wild Horse Island the lake is widest, here having a total extent across of 18 or 19 miles. This island rises several hundred feet out of the lake, and is almost entirely in the western arm, projecting out from the main body of the lake. From the contour of the mainland it is possible for winds to blow up the lake from the lower end, and across the lake from the western arm. These air curents often meet in the open lake east of Wild Horse. Here the wind is most uncertain and the lake roughest. Winds blowing either up or down the lake may meet other winds from the bay. South of the islands the lake is rarely rough.

But when the lake gets real bad it seems as though Neptune was in a rage and had stirred up the waters to the bottom. In ten minutes the lake may change from a perfect calm to a sea on which small boats will hesitate to go, and which may even keep the larger boats in harbor. The surf beats as in larger lakes. One morning we started home in a 32-foot steamer. A mile out large waves were met coming up the lake which caused us to turn back to keep from getting our valuable material and specimens wet. Three days after a second start was made. We hugged shore for six miles, when the strong wind piled the waters so high we sought the shelter of Wood's Bay. Before we could get to shelter the wind died down so the journey could be resumed. When half way down and we were congratulating ourselves on crossing the widest part without trouble, a wind sprang up which increased in a few minutes to such proportions that the pilot was wet from head to foot, and we were obliged to seek shelter behind the nearest land, an island. In about three hours the journey was resumed. In the evening the lake was quiet.

During the summer, June, July and August, the lake is comparatively quiet, and the winds as given above generally prevail. In spring and fall they are uncertain, and may come up strongly from any quarter in a short time. On the occasion mentioned when waves turned us back after starting homeward the waters were driven by a strong south wind. On entering the harbor, the mouth of Swan river, a little over a mile of travel, a light breeze blew from the north east, apparently from the mountains. All day the waves rolled, but subsided toward evening.

As a result of these conditions small boats work close in shore. Row boats seldom go far out in the lake. To attempt to cross the lake in one would be very unwise. Fatalities do not occur because people are careful. As most of the residents are unfamiliar with boats in rough water and necessity does not drive them on the lake there are not likely to be reckless or foolish trips in rough water.

In the summer of 1902 a dam was constructed across the river at the outlet of the lake. This dam was made as follows. Piles were driven by machinery into the river bed eight feet apart. The row of piling extended across the river from side to side. Two inch plank were nailed together side by side in threes, fastened by strips. Each set of three planks was then pushed down into the water, held by the current against two posts or piles. The ends were therefore between the piling, and could not be fastened. The idea was to hold back the lake water, prevent the surface from getting low in winter, and thus have depth of water sufficient to float logs at the new mill at the north end of the lake. In low water it is difficult to get logs to the tramway. What the result may be is in the future. The farmers at the upper end of the lake want the water to run out faster, so as not to flood the land. If the scheme of holding back the water succeeds in winter it is likely to succeed in spring when the waters are high. In that event the flooding of land above will be worse than ever. It is probable, however, that the dam will be taken out in the spring by ice.

Daphnia Pond.

Daphnia pond, so-called on account of the great numbers of **Daphnia pulex** found in it, is a small pond of some ten to fifteen acres. It is about a mile and a half from the Station, alongside the regular wagon road, and only about a half mile from the lake, but at a little higher altitude. This pond is no doubt of glacial origin. In the center the water is about twenty feet deep, but for the most part the pond is shallow and overgrown with rank vegetation, offering an excellent harbor for smaller forms of life. No fish have as yet gotten into this water, and consequently the invertebrate fauna is not affected by them, and has few enemies. It is a typical place to study some of the forms of life found therein, living as they do under very favorable conditions. The varied and abundant life in this small pond is in strange and striking contrast to the limited quantity and paucity of species in the large lake, so short a distance away.

Being in such close proximity to the laboratory it has received considerable attention, and is a favorite resort for those seeking material. In or near Daphnia pond may be found the following specimens:

SHELLS.

Planorbis trivolvis Say; abundant.

Sphaerium partumeium Say; abundant.

Physa ampullacea Gld.; rather common.

Pyramidula strigosa cooperi W. G. B.; in damp places along banks of Flathead lake.

ENTOMOSTRACA.

Daphnia pulex; exceedingly abundant, making the color of the water dirty red. May be taken by the spoonful or pint.

Diaptomus lintoni Forbes; common, but much less abundant.

Cyclops pulchellus Koch; not uncommon.

Gammarus, probably two species, one large, an inch in length, swimming among the water lilies.

ODONATA.

Aeschna constricta, Say; abundant; exuviae to be had in quantity on the rushes and cattails. The adults are on the wing in large numbers in late July and early August. During the first week in August, 1901, an American bittern, **Botaurus lentiginosus** Montag., was shot whose stomach was crammed with dragonflies of this species.

Libellula pulchella Drury; next in size to the preceding. Emerges before August.

Libellula quadrimaculata; on the wing as early as July 8 in 1901.

Lestes unginculata; Hag.; in 1899 this species was emerging in large numbers during the last two weeks in July. In 1901 they were just emerging July 8.

Lestes disjuncta; in smaller numbers than preceding, emerging at the same time.

Enallagma calverti Morse; on the wing early in July; the most abundant of dragonflies at the pond.

Enallagma praevarum Hag.; a few specimens captured.

Sympetrum scotica Donov.; rather abundant in 1899. Scarce in 1901.

Sympetrum obtrusa, var. **assimilata** Uhler; perhaps the most abundant dragonfly in Western Montana.

Ischnura is not uncommon in the vegetation near the water's edge.

The above list is not large, but is about as many as one usually finds in any one locality in the state.

Other material to be found in the pond in abundance may be mentioned; many beetles, dipterous larvae, two leeches, several case worms, many water bugs and worms.

The vicinity of this pond is a great breeding place for birds. It is here that the ornithologist may do some good work. To give a list of those choosing this for a nesting place is unnecessary repetition, as this has been given elsewhere. No fewer than forty-five to fifty migrants build their nests and rear their young within a hundred yards of the water's edge. For so small a pond this is certainly a remarkable showing. On all sides the timber has been destroyed by fire. Thus most of the shelter formerly afforded has been removed. The nesting sites are confind to the low bushes along the water's edge, to those which have sprung up on the burnt area, to the dead boles left by the fire, and to the grass and reeds of the pond. Rails are heard daily as they move around among the weeds. Golden-eyes and grebes usually rear their young in the grass. Catbirds, western yellow-throats, flycatchers, chackadees, sparrows, juncos and woodpeckers all are found. The tree dwelling warblers find a few trees near by. Kingbirds may always be noticed, noisily chattering as they leave their perches in pursuit of insects. In this open country the ornithologists of the shotgun or of the opera glass may alike find suitable field for work. It is but fair to our workers to say that very few birds have been killed around this pond.

Frogs, garter snakes, a single species of turtle, and an occasional muskrat, may be found on the banks or in the water. The white tailed deer has often been seen close to the pond, and annually black bears are known to frequent the bushes adjacent in search of berries. Not only is there an excellent field near this pond for study and for gathering material, but the study is frequently intensified by the sudden appearance of a frightened deer or the hasty and noisy departure of a black bear as the collector wanders over the hills.

No attempt will here be made to give the names of species of plants.

The vegetation is abundant, and offers splendid opportunity for studying plant communities.

A short distance below Daphnia pond, along the wagon road, is a second glacial pond, named Estey pond. This is larger than Daphnia, deeper, and like Daphnia teems with life. It has no outlet, and like Echo lake suddenly rose in height a few years ago, remaining to the present at the higher level.

ROST LAKE. (MUD LAKE.)

This is a small lake, elliptical in outline, lying between Echo lake and Swan river. It is but a few miles from either of the preceding, and about three miles from the base of the Swan range. This range rises abruptly from the plain, as does the Mission mountains, and was elevated in a similar manner. It may be seen by reference to Plate XXXVII, the small lake in the center of the illustration. Plate XLIV shows a general view of the lake from the outlet.

The lake is a little over a mile in length from north to south, its width being about two-thirds its length. It is densely timbered with fir, spruce, white and yellow pine, birch, cottonwood, and alder on all sides, with small meadows here and there. Between the lake and the mountains is a gradually sloping plain, with dense forest, crossed by a few small streams whose sources are in the gulches on the mountain sides. The upper end of the lake is very marshy, much of it swampy, with sphagnum bogs and many small rivulets whose waters reach the lake through tortuous channels. West of the lake the forest extends with gradual slope to the low hills along Flathead lake and river. The forest near Rost lake is damp and swampy for the greater portion of the year. So soft is the soil that the few settlers have been obliged to corduroy the winding road cut through the lodge poles for a distance of nearly a mile. Most of the country about this and Echo lake supports a dense undergrowth of thimble berry bushes.

The lake itself is shallow, with deep mud bottom. In most places the water is but a few feet deep, in no place was it discovered to be more than eight or ten feet. In the shallow water a long oar could be pushed down full length in the mud. As a result of this surface of shallow water the sun's rays in summer warm up the waters more than in any river or pond of the region, and the animal life and vegetation is correspondingly rich and varied.

In early September, 1902, the waters of the lake were remarkably shallow. The passage up and down the lake was made several times in the canvas boat, carrying two men. With this load the boat was usually stirring up the mud in the bottom, although the water was perfectly clear. In many places it was almost impossible to row. A few spots were found where the water was three or four feet deep. In landing at the upper end the boat was dragged by the oars through mud to a hummock of grass. We were then obliged to carefully pick the way out by stepping from hummock to hummock. A misstep on one occasion resulted in a sudden drop to the waist before the hands could be thrown out. It was only by quick and active movement that I regained the solid? ground.

Immediately around the waters of the lake the growth of native grass is rank. Where it is possible the residents cut this for winter hay.

In 1902, a row boat could land only in a few places, so gradually does the water deepen, and so deep is the mud. The vegetation is encroaching on the lake very fast. Rushes, water lilies, potamogetons, and other hydrophytic forms grow even in the middle of the lake. As a consequence, although there are several small creeks bringing water into the lake there is no perceptible current across it.

It would not require much work to lower the outlet so as to practically drain the lake. There is talk of damming the outlet for logging purposes. The idea is to make the water deep enough to float logs in early spring. It is only a little over a mile by section lines to the river. The creek could easily be cleared to float logs in the spring. By this plan it is hoped to get at the marketable timber with moderate cost of removal.

The timber in the vicinity of the lake is as follows: Yellow pine, **Pinus scopulorum** Engl., is quite abundant. The young trees of this species are by lumberman termed "bull pine," and are considered very inferior to what they term "Yellow pine."* There can be no doubt that the "bull pine" is but the early growth of the yellow pine. This is one of the most common trees in the western part of the state. In the wet and swampy land about the lake it is not abundant, being displaced or perhaps replaced by others. It is not uncommon to find trees from three to five feet in diameter. The tree is usually tall, free from limbs, making excellent timber.

Red fir, or Douglas' Spruce, **Pseudotsuga mucronata**, Raf., is the "oak" of Montana. It is the fir (false fir) of the Puget sound region in a higher, drier, and more unfavorable climate. In the Rost lake region it is not so abundant as some other species, but along the mountain slopes it becomes more common. Westward toward the dry and open prairie it attains considerable size. Between Rost and Swan lakes, a distance of some eight or ten miles, the red fir is very abundant, much of it young growth.

The cottonwood, **Populus angustifolia** James, is found around the borders of the lake and in wet places. Many of the trees are large. In this region there are no cottonwood belts as elsewhere, and the tree may be spoken of as "not uncommon."

Englemann's spruce **Picea englemanni** Engl., is the most abundant tree about the lake, save perhaps the lodgepole pine. It is a beautiful tree, tall and stately. North of the lake is a wet and swampy region with many meadows. Here this spruce is dwarfed, stunted and reduced in size. The trees are not marketable. In other places it becomes a large tree. It does not seem to be so well known among lumbermen as the yellow pine, fir or tamarack. As there are great quantities of this spruce in Western Montana it will no doubt be better known later.

The lodge pole pine, **Pinus murrayana**, Eng., is very abundant in the region of Rost lake, as also Echo lake. In many places it completely occupies the land, apparently to the exclusion of all other timber. In some sections the trees are small, a few inches in diameter and a thick stand. In other places they have attained large size for lodge pole, a foot or more in diametter. The lodge pole is not used for marketable timber, perhaps because the trees are too small. It seems to make good "shakes" and to be serviceable where it may stay dry, as in houses, stables and fences. It is reported to be not good for posts. Corduroy roads are made of it.

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* I am informed that lumbermen at Missoula and Hamilton consider the bull pine or young yellow pine superior to the older trees, yellow pine proper.

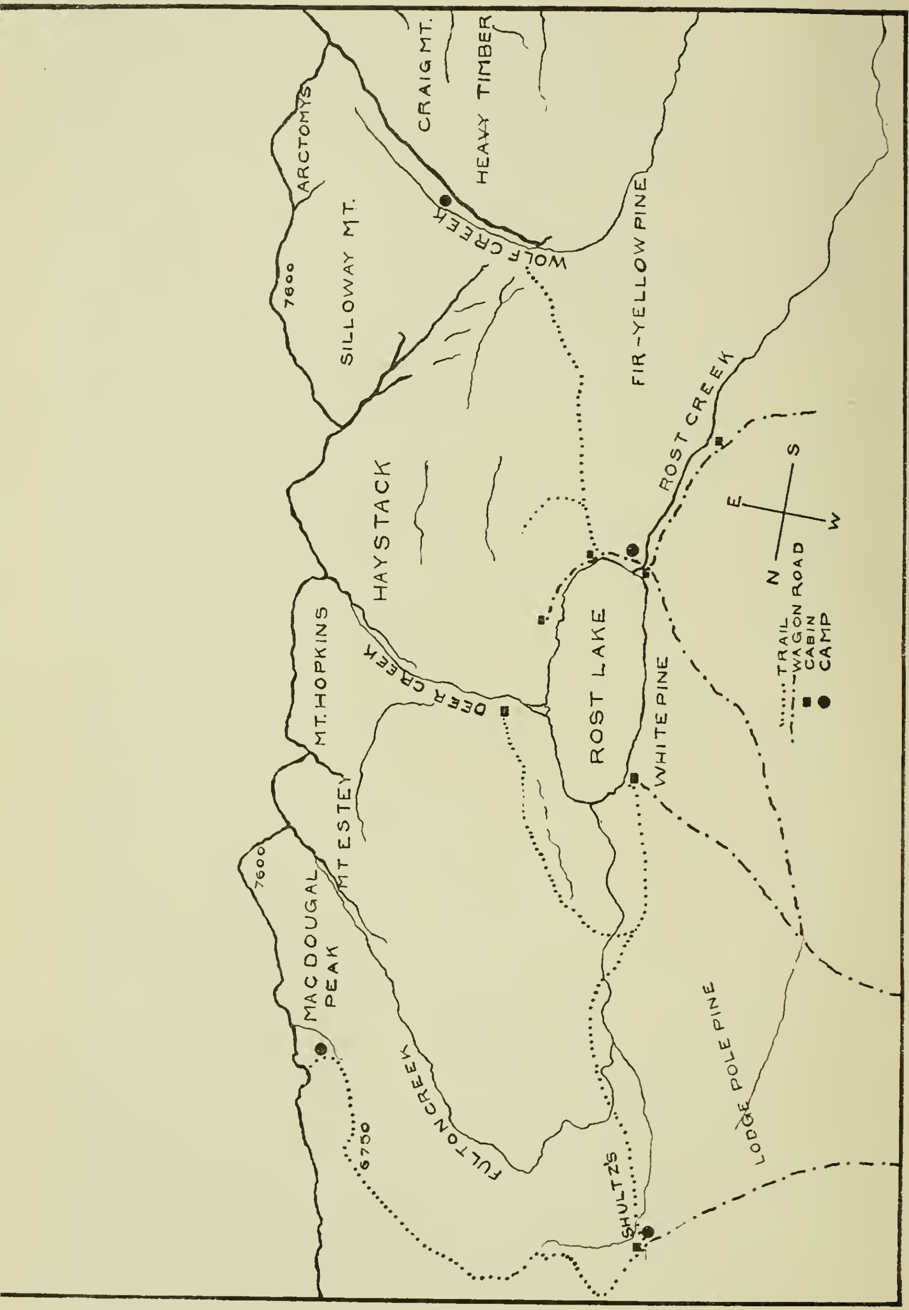
ARCTOMYS
CRAIG MT.
HEAVY TIMBER
7600
SILLOWAY MT.
WOLF CREEK
FIR-YELLOW PINE
ROST CREEK
HAYSTACK
E
S
N
W
TRAIL
WAGON ROAD
CABIN
CAMP
MT. HOPKINS
DEER CREEK
ROST LAKE
WHITE PINE
MT ESTEY
7600
MACDOUGAL PEAK
LODGE POLE PINE
FULTON CREEK
6750
SHULTZ'S

Fig. 3. Sketch showing some of the details of country in the vicinity of Rost Lake.

The white pine, **Pinus monticola**, Dougl., is not infrequent about the lake. Toward the Swan range it becomes more abundant. It seems to be more or less common along the western slope of the Swan range from Swan lake north to Flathead river. Large trees from 7 to 10 feet in circumference are not uncommon, and trees with diameter of 18 inches to 2 feet may be called abundant. This tree has not been lumbered much, and its true worth is not appreciated. However, compared with other lumber white pine is not common.

The western larch or tamarack **Larix occidentalis**, Nutt., is one of the best known trees of the state. There is considerable large timber near Rost lake. The trees are usually tall, clean, and free from knots. Much of the marketable timber of choice size and cutting will be of this species.

The balsam fir, **Abies grandis**, grows abundantly in this wet and shaded region, in some cases attaining the dignity of a tree of from 12 to 15 inches in diameter.

Here, also, the white birch thrives. Many trees large enough for logs are growing near the lake and along the mountain side in the wet region. Many a "curly birch" knot has been seen which from its size would make fine cuttings. The birch of this section will probably be utilized later. **Betula payrifera** makes a beautiful tree, conspicuous by its white bark. As is perhaps well known, in its early stages the bark is red. It may then be taken for the red birch, **Betula nigra**, L., which is not common in the region. The swamp birch, **Betula glandulosa**, Michx., is everywhere abundant around the border of the lake, growing in large clusters from a common starting place like a rose bush. It even attains to the dignity of a tree, four or five inches in diameter and fifteen or twenty feet high.

The white cedar or arbor-vitae, **Thuja plicata**, Don., grows in considerable quantity in many places in the region. Its value is well known, though little timber has been used except for "shakes" and posts. The cedar timber is practically untouched around Rost lake.

The hemlock, **Tsuga**, grows sparingly, but has not been seen within several miles of the lake. How abundant it may be along the mountains is at present not known to the writer.

Among the shrubs may be mentioned the ever present alder, and the yew. The former occurs along the banks of all the streams. The latter occurs on the mountain slopes, where it is a matted underbrush, spreading over the ground, an impediment to travel, but less difficult by far to penetrate than **Ceanothus** or **Menziesii**, both or either of which may be encountered. It was a rare pleasure to find in late August the ripe berries of the yew. I had never seen them before. The little red cup, the size of a pea, surrounding a central seed, the whole surmounting a slender branch of the evergreen, was very beautiful. They were sweet and pleasant to the taste. As we flushed several fool hens among the bushes the berries are no doubt eaten by these game birds.

It is unnecessary to mention the willows, three species of which were noticed, as they are ever present in the damper places in the valleys as also high up, even to the alpine regions. As Harry N. Whitford, of the University of Chicago, is making a careful study of the forests of the region adjacent to the Biological Station it would be unwise to forestall any of his work or enter the field he has chosen by generalizations as to the influences which have caused the present distribution of the different species of forest trees. All this will be given in his final report, which will be published later, no doubt.

Rost lake is a typical example of a body of water being filled in by sediment and having its inlets, outlet, and sides choked by hydrophytic vegetation. This vegetation is encroaching on the lake in every direction. The annual rise and fall of the lake is several feet, and for a hundred feet or more in every direction from the lake the vegetation was profuse and abundant, at the time of our stay, early July. In the spring the surface of the lake is considerably larger.

The outlet of the lake, Rost creek, carries the water into Swan river. The lake has no driftwood. The inlets are too small to carry drift, and the edge is too swampy to permit forest vegetation close enough to the water to have fallen timber in the water.

This is locally known as Mud lake. It figures on most of the maps as Rost lake, improperly spelled Ross. The name was given because of the early residence at the lake of a Swede named Rost.

The lake is apparently of glacial origin. In a short time it will be filled up. The grassy meadows in the immediate vicinity, all of them wet and swampy, are no doubt smaller lakes or portions of this lake that have been filled up by sediment and hydrophytic vegetation.

As was stated, the animal and vegetable life is quite varied. Clustered about the dead stumps of the rushes were large masses of a fresh water sponge, Spongilla, green in color, with long fingerlike arms waving in the water. Very few shells were found. In the creek below the outlet a few young **Margaritana margaritifera** were taken. A single dead **Physa heterostropha** was picked up in the mud bottom, while a few **Pyramidula strigosa** var. **Cooperi** were found in the adjacent woods.

In Odonata the lake showed greater numbers and abundance than any similar region studied in the state. Many species were just emerging from the water. A **Calopteryx**, the first seen in the state and the first reported, was found rather abundantly. **Sympetrum rubincundula** was emerging, July 14, in large numbers, the specimens being fresh and uncolored. **Aeschna constricta** was on the wing, the exuviae being found on the rushes in numbers. **Ischnura** was common. **Libellula pulchella** was just emerging, in considerable numbers. **Libellula quadrimaculata** was on the wing, and captured specimens showed that they had been out for some time. Two species of **Lestes** were on the wing in considerable numbers, the larger number just emerging. A dark colored **Sympetrum** was sparingly distributed, difficult to catch, a single one being taken. **Enallagma calverti** Morse, was quite abundant, some on the wing, others emerging. A **Mesothemis, M. simplicicollis**, was occasionally seen, and one was captured on the mountain eastward at an altitude of over 7,000 feet.

Calopteryx yakima Hag. See Psyche, 1889, pp. 248-9.

Hagen described this species from specimens collected at Lone Tree, near the Yakima river, Wash. He says the discovery of a species of **Calopteryx** west of the Rocky mountains was very unexpected and rather startling, the more as the species seemed to be different from all known to occur in North America. He also says: "I cannot but believe that some of the northwestern species pass east by the passage above Missoula, where the principal range of the Rocky mountains ends, and perhaps by the upper parts of the Columbia river. As far as I know, such species are, until now, not to be found in eastern Canada or in Maine. Of course when species can come east in such a way it is possible that some could go west in the same way, and would be, perhaps, modified by the climate. So I found it necessary to compare carefully with **C. yakima** the **C. hudsonica** from Michipicoten and **C. aequabilis.**"

From July 7 to 14, 1901, specimens were captured. The insects were taken from the log bridge at the outlet of the lake, on which they congregated. The collection was made gradually. Perhaps a half dozen would be seen on the bridge or in the rushes. When these were captured or driven off it would be some time before others would assemble. During the week's stay at the lake 26 males and 24 females were taken. They were all well colored, showing that they had been out for some time. They were not seen at Echo lake, a few miles further to the northwest, nor have they been seen anywhere else in western Montana. But dragonfly collecting in Montana has not been carried on very extensively.

Calvert considers **C. yakima** the same as **C. aequabilis**, the eastern insect.

Taking **C. yakima** at Rost lake indicates that this eastern dragonfly has effected passage across the Rockies in Montana, and above Missoula, as suspected by Hagen. Later investigations may show the exact place in the mountains where the species crossed over. It is quite probable that the species has crossed at Lewis and Clarke Pass, whose altitude is 6,323, from P. R. R. reports. The waters of the Missouri and of the Columbia are but a short distance apart, and the pass is low. Since the species has not been seen around Missoula it is likely, if the above pass was the passage, that the species has followed the Big Blackfoot through the upper part of its course and then passed over to the Swan river, and down that to Swan lake, from which opens up the large wooded valley in which Rost lake lies.

It will be apparent to the reader that the dragonfly in question has crossed the Rocky mountains, but that the passage has been from the east side westward, and not as Hagen supposed, from west side eastward. Further, the passage has been recent, since **C. yakima** and **C. aequabilis**, although on opposite sides of the range, have not sufficient marks of distinction to be considered even as separate races.

Since capturing these specimens I now recall an occasion when a single specimen was thought to be seen at the Biological Station. As I was passing through a barn lot on my way to lunch I was sure I saw a Calopteryx in the weeds some distance off. I had no net, but grabbed my hat and made chase. I was sure I had seen one glimpse of a Calopteryx but was unable to find it.

It is hardly likely the species crossed at the Marias Pass, whose altitude is 8,500 feet. Nor is it at all likely the species crossed over north of this, as the mountains are abrupt, high, and the streams very cold. If the passage has been any place in the range south of Lewis and Clarke

Pass it would be to a stream leading into Clarke's Fork through Missoula, where it has not been seen.

It is hoped soon to make an expedition to the headwaters of the Big Blackfoot and Swan rivers, when the question may be settled.

Few water birds were seen on the lake. It does not seem to be a favorite resort for them. Although there are several species of fish they do not seem to thrive in the warm waters of the lake. It is possible later investigations may show this to be a good breeding place, as Entomostraca are quite abundant. Other forms of animal life, such as larval Diptera and Odonata, leeches and worms have not been determined except in case of adult dragonflies.

Plate XLIV is a good view of this very interesting lake. The photograph was made from the bridge at the outlet. The view is northeast, up the lake. In the foreground is a bed of pond lilies. Rushes almost choke the stream. The dense vegetation along the shore line is plainly discernible. The wooded valley is a great shelter for white-tailed deer. During ten days stay in the region not a day passed without some one of the party either seeing or hearing an animal. Bear are abundant in the hills.

In the hills east of the lake mountain goats are reported. In former years an occasional moose is said to have reached this region, though none are now seen. Their spoor is found in the mountains shown in the background. Elk and black-tailed or mule deer were also formerly taken in this region. The former are no longer seen, and the latter only occasionally. But the white-tailed or Virginia deer roams the forests in the summer from the settlements to the summits of the range, altiude 7,500 feet. They have been seen on the snow banks almost at the summits. They are fond of lying in the open places on the high ridges in summer. Here they escape in part from their worst enemies, the flies. Food is abundant. They bask in the sun, rarely disturbed by man.

It was stated that the borders of Rost lake contained many sphagnum bogs, mud holes and swamps. In July we traveled miles of meadows and bogs with scarcely a dry knoll during the entire distance. In these marshes, which are no doubt deep in early spring, there must be an abundance of smaller life.

Among the interesting features presented by a brief stay at this lake was the information that all the deer were badly infested by a liver fluke. Numerous reports came regarding the "bloodsuckers" that were in the liver of every deer, etc. Coming from reliable sources these stories could not be denied. The first specimen examined after hearing these reports had two large flukes encysted in the liver. Old residents make the statement that "when you kill a big old buck in the fall, take out his liver and shake it, it is so rotten with blooksuckers it falls to pieces." The life hisory of this fluke will be an interesting study for some one. From the shells thus far found the early stages are likely to be in a **Physa**, although **Planorbis trivolvis** should be present in the region.

Next to Daphnia pond Rost lake has greatest interest for students at the Biological Station.

Echo Lake.

This interesting lake lies close to the Swan range of the Kootenai mountains, between the Swan range and Flathead river. It is but eight or nine miles from the Biological Station.

The outline of the lake is very irregular. From the mountain tops the outline very much resembles the letter H, with small projections in different directions. This may be studied from examination of Plate XXXVII. The total shore line of the lake, including all the arms, is said to be from 12 to 14 miles. The width varies from a half mile to a narrow neck.

Its depth is said to be great at the eastern arm, the head of the lake, but the soundings showed less than 20 feet.

The lake has no surface outlet. The waters are held in by glacial deposit, evidently a portion of a moraine. The waters escape through an underground outlet, finally reaching Flathead river, though just where the outlet is or how far it extends underground is not yet known.

Very recent, or present connection with some large body of water is indicated by the presence of at least four species of fish, the squawfish, **Ptychocheilus oregonensis**, Rich., whitefish, **Corregonus williamsoni**, Girard, minnow, **Leuciscus**, probably **gilli**, and trout, **Salmo mykiss**. It is said to have suckers, **Catostomus**, also. A very large spring is reported a short distance from the lake on the west, but it has not yet been examined.

The lake has an annual rise of from five to seven feet, the waters filling up with the melting of snow in the spring and summer, reaching the low stage again late in the fall or early in the winter. The drainage is from a small portion of the west slope of the Swan range, and a small portion of the timbered valley adjacent to the waters of the lake.

The lake lies in a trough or depression in the wooded valley. Its banks are steep slopes, leading up to the valley plain, densely wooded with fir, tamarack, lodgepole pine, yellow pine, and an occasional white pine. Maple, alder, cottonwood and birch are present, but less numerous.

In the year 1894 the surface of the lake rose during the freshet to a point some ten or twelve feet above its usual height, and has remained so ever since. This elevation of water surface, and consequent submergence of land, appears to be due not to the submergence by sinking of land surface, but to filling up the underground outlet, preventing the water from escaping. This additional depth of water has drowned considerable vegetation, and in one case has submerged a meadow of several acres, including house, barn, and fences, the lake water covering to a depth of several feet what was formerly a meadow and garden. The old house at present has the water half way up the door, whereas previous to the rise it was on the bank of a creek emptying into the lake. What was formerly the mouth of the creek, and for a quarter of a mile back, is now a part of the lake. This is plainly shown in Plate XLII. The bridge in the illustration formerly spanned the creek. The water is new lake.

This photograph was taken during the summer of 1901. In 1902 a visit to the lake at the same place shows that the water has risen several feet higher in the lake, to the eaves of the log house in Plate XLII.

This seems to prove the statement made relative to the closure of the underground channel. If the lake continues to rise from year to year the results may be disastrous, as it may overflow the bank at some point, doing much damage.

Echo lake has not received extensive study, and offers a very promising field for a summer's work for some one who wishes to undertake it.

There are morainal hills a hundred feet or more in height between the lake and Flathead river. Ranchers, in digging wells, pass through alternate layers of sand and gravel containing water. The indications point to the existence of this sand and gravel from Echo lake to or near to Flathead river.

The canyons in the mountain sides to the east of Echo lake show distinct evidences of glaciation, leading from the slopes down into the valley. These various smaller glaciers from the west side of the Swan range and from the east side of the Mission range merged into one large glacier, which must have pushed down (northward) the Swan river valley. In Plate XXXVII the movement would be from left to right. At the same time a much larger ice mass was moving down the valley of the Flathead river and across Flathead lake. Evidences of this ice mass exist about Kalispell, along the shores of Flathead lake, and in the Mission valley to the south of Flathead lake. At the foot of Flathead lake the large and distinct moraine stretches from the Mission mountains on the east across the end of the lake to the Cabinents on the west, decreasing toward the west, and cut by the outlet of Flathead lake. As the ice river from Swan river valley moved northward it was met, almost at right angles, by the larger ice sheet covering the Flathead valley. The place of meeting should be the valley shown in the middle of Plate XXXVII.

The Mission range ends as such in the low hills south and west of Echo lake, in the immediate vicinity of the Biological laboratory. These hills may be seen in Plate XXXVII to the left and immediately in front of Flathead lake. This northern end shows distinct evidences of glacial tion. Large boulders, with abundant and deep striations lie at or near the summits.

The contour of the land indicates that Swan river formely had its course northward, instead of turning to the west as is now the case. When the river and valley were filled with ice, meeting the larger ice mass, the larger mass caused a deflection of the smaller (Swan river valley) mass causing it to pile upon and flow over the lower slopes of the Mission range. This deflection probably aided in carving the present channel of Swan river, where it makes an abrupt turn and passes through a short and steep descent to the lake.

The retreat of the main ice sheet was probably more rapid than that of the Swan river valley mass, owing to the close proximity of mountain ranges feeding the latter. The result was a morainal deposit at what should be the surface outlet and what is the underground outlet, of Echo lake. Echo lake therefore appears to be either a portion of the old river bed, or a depression left in the morainal mass by the retreat of the ice.

It seems very probable that the Swan river formerly flowed north along the base of the Swan range on the west, emptying into Flathead river north of Columbia Falls. The evidence for this is as follows. Between Rost lake and Swan river, a distance of but a little over a mile, the surface is low, level, boggy, and swampy. The impression is that the soil is the recently uncovered bottom of a quiet lake. Rost lake has been described. North of this lake for several miles the surface alternates with open and wet meadows, boggy woods, and swamps that partially dry in summer. This condition seems to prevail north to the end of the Swan range. Pasing from the mountains westward at Rost lake the surface is as follows: First are the timbered slopes immediately west of the range; next is the mud bottomed lake with its swampy border; then come the open woods on higher and drier morainal sandy soil; further west is the low end of the Mission range, rounded by ice; beyond is the valley of the Flathead river.

North of this line just drawn the swamp region takes the place of Rost lake, widening so as to include Echo lake and territory east of it. Further north the end of the Mission range disappears, blending with the morainal drift, which lies continuous with the Mission and parallel with the Swan range. The low and wet belt, narrowing to a small strip, lies between the morainal ridges and the mountains. The only explanation to be offered for this conspicuously low and swampy region is that it is the remnant of the old stream.

Adopting this view as a basis for argument it would appear that the river formerly flowed north as previously indicated. In the Rost lake region it probably widened into a lake with swampy bottom.

I have no opinion as yet concerning the manner of closing the channel so as to turn the river westward. The great bend made by the water as it flows north from Swan lake, then west, south and again west seems to indicate a dam by ice, possibly an unusual ice flow from the region of MacDougal peak, where remnants of glaciers still remain. In event of such an ice dam, which may have occurred farther north than the point suggested, even to Flathead river, the waters from the west side of the Swan and east side of the Mission ranges would be imprisoned, damming up far beyond the present head of Swan lake. The elevation necessary in order to overflow westward across the end of the Mission range is not determined, but it is not great. The water began cutting through the low gap. The cutting was rapid. The water meandered over the wide level valley left comparatively dry, seeking escape, finally making the present tortouous channel.

The lake is a place of great interest to a biologist. Having no surface outlet its animal life presents many striking peculiarities. In its waters was found a new hydra, **Hydra corala** Elrod and Ricker, elsewhere described. In the same locality where the hydra was collected was found a species of Polygonum which has been growing in shallow water since the rise of the lake, before that being undoubtedly on dry meadow banks. This plant has accommodated itself to its new surroundings, and adapted its structure to the new conditions. The joints are swollen to considerable proportions, conspicuously noticeable. The lake contains an abundance of entomostracan life.

Swan Lake.

From Swan lake to the Mission mountains westward the distance is perhaps not more than six miles. It lies in a direction north and south, parallel with Flathead lake. It was evidently formed by the same geological method, faulting, the western half of the uplift of the Swan range falling after the upheaval, thus making the valley between the Swan and mission ranges, in which Swan lake lies.

From the laboratory at the outlet of Swan river to Swan lake is perhaps eight miles. The road winds through the forests and along the river, mostly through unfenced country, scarcely touched by the hand of man. There are a few houses along the road, several more between the road and the mountains to the west. The timber close to the road is mostly lodge pole pine, **Pinus Murrayana**, Engl., and Douglas spruce, **Pseudotsuga mucronata**, Raf. Occasionally in the smaller timber there rises the tall trunk of a monster tamarack or yellow pine, showing that in days gone by a different forest growth covered the country. Towards the Mission range there is considerable low and swampy land, apparently the remains of a portion of the old lake before mentioned, where is to be found an abundant growth of arbor-vitae, or white cedar, **Thuja plicata**, Don. Some of the mountain spurs have a dense growth of young timber of this species, so thick that the sun scarcely strikes the ground through the foliage, and where underbrush and other vegetation are entirely wanting. In passing through such timber one is continually squeezing between small trunks, often no thicker than one's arm, breaking limbs to make a passage, with nothing but dead leaves underfoot. It is impossible to see out in any direction. One must follow the compass, not knowing whether before there is a lake, a swamp, a steep slope, or open woods.

While exploring a portion of this region we came upon some blazes on the trees. At first these were supposed to be the marks of the surveyors. The compass showed them to be out of line with the directions which surveyors would take, and the question then was as to what the blazes would mean. It was decided to follow them up the mountain side, through the dense timber. The way wandered much through the woods, apparently taking an uncertain direction. They were certainly made by some one who was undecided as to his bearings. They fianally led up the mountain side to a tree well cut, barked almost around the trunk. From indications it was decided that some hunter a few years before had killed an animal at this spot, and had blazed his way out in order to be able to return for his game.

On this same trip, leaving the blazed trail before mentioned, we took the direction of the compass southeast, wishing to come out at a lake reported to lie between the river and the Mission mountains, a little north of Swan lake. The timber was very thick, and a view impossible. Following down a ridge which we had been ascending for some time, we came in sight of a small lake, covering but a few acres, lying in a pocket between two steep slopes. As we descended to the lake shore a pair of golden-eye ducks started in affright. A kingfisher noisily resented our intrusion, perhaps the first for a long time. A flicker called from a nearby tree, and drummed loudly. Otherwise the woods seemed to be silent. The lake was almost choked by hydrophytic vegetation. The waters were of a beautiful blue color, causing exclamations of surprise and delight. We were not prepared to make examination of the water.

The ridge proved to be morainal, as shown by the rounded pebbles and stranded boulders on the surface. It continues to the lake, as we afterwards discovered, cutting the lake in twain, really making the lake double. This body of water is perhaps a mile or more across, somewhat elliptical in outline, timbered to the edge, and unexplored. The ridge cutting the lake in two meets the waters of the lake approximatly at the middle, extending from side to side of the lake. The morainal ridge extends almost due east and west, The ridge is sharp and steep, and at the same time narrow. On the summit the distance across is but a few feet. In height it is perhaps a hundred feet above the water. It is well wooded with small timber. On the north the trees are arbor-vitae, on the south Douglas spruce. It is a place where the sharpest line yet observed is drawn between forest growth of two different species, showing plainly how slight differences in location may make sufficient difference to give one species an advantage over the other. The southern side of the sharp ridge faces the sun, is dry, and supports Douglas spruce. The north slope holds more moisture, gets much less sun, better suited to the growth of cedar.

A portion of this lake to the north has receded so as to uncover the ground, leaving a marshy meadow on which native hay grows in abundance. This is cut by thrifty ranchers for winter use. The lake is not named, is little known, and biologically is unexplored. As our trip on this occasion was hasty and merely for preliminary purposes no attempt was made to collect material. Indeed, it was late when we returned home from this hasty reconoissance, much as we desired to make more careful examination. That must be left for future years.

On the ridge between the two portions of the lake a place was noticed where the grass and other vegetation was apparently trampled and mashed down as though a conflict had taken place. At first it was taken for the bed of a deer, but there was a marked difference in appearance between this and the ordinary deer bed. Examination disclosd the wasted skeleton of a porcupine, yet covered by portions of skin, and abundantly protected by long quills. The fight had taken place at the foot of a fir tree. Evidently the porcupine had just descended from the tree, when he was seized by an enemy, probably a wolf.

Along the bank of the old lake referred to as meadow was found the partly decayed skeleton of a fine white-tailed buck. He had a large pair of antlers, which were still covered with velvet. His death can only be conjectured, but must no doubt be referred to the hunter. Unfortunately his antlers were badly eaten by rodents, hence they were useless. On the border of the meadow a fine buck was rousd from his midday slumbers. The timber was dense, and the first bound put him behind such a mass of tree trunks as to make a shot impossible. Up in the wods we came across the fresh spoor of a bear. An old beaver dam separated the meadow into two portions. On the return we flushed three flocks of ruffed grouse, each containing a half dozen or more birds. It is apparently a good game region.

Swan lake is a beautiful sheet of water. It is but the widening of the river, the remnants of much larger lake, both at the upper and lower ends. It is estimated to be twelve miles long, but this estimate is probably a mile or more in excess of the true length. It is narrow except at the upper end. Here it broadens, making a circular bay perhaps three miles wide. Soundings have been taken at the lower end, and to a point about half way up. The deepest sounding taken was about eighty feet. At the lower end it is narrow, shallow, and with considerable current.

Above the bay mentioned is a large swampy area, the home of water fowl and aquatic insects. This swamp covers several square miles. At the lake it is densely covered with hydrophytic vegetation, making a dense growth to the height of a man's head. To collect in this region is to wade in water waist deep. It is practically impossible to use a boat, and when a bird is shot it may be irretrievably lost though but a short distance away. As one moves farther south from the lake the swamp vegetation becomes less profuse, finally yielding to grassy meadows. Bordering this the forest makes a shelter for wild game. Through this swamp Spring creek winds its way to the lake. Its outlet is choked by masses of yellow water lilies, floating potamogetons, and great tufts of water crowfoot. It is a very suitable place for fresh water invertebrates. At the outlet of the creek fishing is usually good, and rarely does the visitor push up the creek in a boat at eventide without sight of a deer.

Swan river enters the lake along the slope of the Mission range to the west. It does not empty into the upper end of the lake, but follows parallel to it for a mile or more, meeting the lake far down the bay. The river is a great fishing resort, and is much visited by fishermen and hunters. Many interesting regions are reported along its shores which the writer has not visited.

The shores of the lake are densely wooded. This timber extends up the slopes of both ranges to the rocky nummits. The mountains are not high, not exceeding 7,500 feet, and support timber to the rock crests. The timber is that prevailing in the region, the same species as mentioned for the region adjacent to Rost lake, one species prevailing in one locality, another most abundant at some other place. Most of the timber is of younger growth. The mountain slopes on either side of the lake are well wooded. Indeed, we may say they are densely wooded. The summits on the west are rounded, with no sharp peaks. These begin further to the south. The slope of the Swan range to the west is the more abrupt, since it is the cliff side of the fault. Weathering has reduced the range very much. Ice has no doubt had a great effect in breaking down the sharp ridges. At the upper end there is a small valley between the lake and the base of the mountain. This is very wet, covered with dense forest. Toward the middle and lower portion the hills end at the water's edge, clothed with timber to the base.

The wagon road from the north ends at the outlet of the lake. If one wishes to go farther he must proceed by boat, on foot, or with pack horse. The trail follows the east shore. It is well travelled, and is the only passageway from this region south to the headwaters of Swan river. The trail is kept open by the forest rangers. One may follow it to the headwaters, when it meets a wagon road. This may be followed to the Big Blackfoot river, thence to Missoula.

The upper half of Swan lake, the swamp at the upper end, and the Swan river region mentioned above, lie in the Lewis and Clarke forest reserve. The large timbered area included is therefore under the care of the government, and very little cutting has been done. There are several cabins along the shore of the lake, occupied by hardy pioneers who occupied the land before the Forest Reserve act was made. As a consequence there is little traffic on the lake. The boats are confined to a few row boats owned by different individuals.

During the summer of 1902 a party of thirty-one was taken across the lake to the upper end. A stay of several days was made in scientific work. This party taxed the facilities of the region. All the available boats on the lake were in use, as well as the canvas boat.

On this occasion an ascent was made of Hall's peak. This is a small and rugged rock pile rising out of a wooded slope with three separate humps or shoulders. The altitude is about 7,250. The summit is a sharp ridge, in several places barely wide enough to set foot for passage. On either side it is precipitous. When the rocks are bare of snow the peak is neither difficult nor dangerous to climb. It is necessary to skirt several places where the slope is very steep. With snow there would be no footing. When the surface is bare there is little trouble. It would probably be impossible to ascend this summit when it is covered with snow. Those who have reached it at such times report that they would not attempt the feat. There were a few snow patches below the summit at the time of our ascent, the last week in July. The view was very fine. The air was comparatively clear. Clouds gathered and indicated a rainy descent, but happily there was no rain. Among the party was Miss Pearl Ricker, of DesMoines, who is the first and at this writing the only woman to ascend this mountain.

The mountain is wooded to the very summit, save where the rocks have not disintegrated sufficiently to permit trees to grow. The few stunted and gnarled alpine firs and white-bark pines were small, and showed the great struggle they were making for an existence. Near the summit there was great profusion of spring flowers.

This peak stands out alone from the others in the range. It is connected eastward by a ridge a thousand feet below the summit. Deep and precipitous canyons separates it from the mountains on the north and south.

The mountain is not difficult of ascent, and the climb is devoid of interest until the last 1,200 feet are reached. A trail leads from Bond's cabin to the foot of the mountain. The climb is through dense timber, up a wide mountain face where directions are difficult to follow without the use of compass. There is no view in any directions save an occasional glimpse of the lake until the foot of the cliffs at the summit is reached. From this up the view is superb.

The most impressive feature of the panorama spread before the eye is the great stretch of timbered country visible. Westward to the summit of the Mission range there is nothing to be seen of the mountains, so well are they hidden by the forests of pine, fir, and tamarack. The lake with its swamp and meadow relieves the somewhat monotonous view of forest, and sparkles and glistens in comparison with the sombre green of the trees. It looks beautiful in the valley far below. To the south is the timber belt along the Swan river. Pathless save for the trail mentioned, unbroken by the woodman's ax save for the few trees cut by the early settlers along the lake shore, it stretches as far as the eye can reach, and dimly beyond may be seen the high snow crowned summits marking the valley yet almost unknown. On the right may be seen the high summits of the Mission range, McDonald being most conspicuous. To the left Swan peak rises high towards the clouds, and in late summer wears a crown of white. Eastward the lower summits hide the wooded valley of the South fork. Everywhere forests greet the eye. No one can comprehend the enormous quantities of marketable timber visible from the summit of this mountain, almost all of which is in the forest reserve.

While the ascent is largely devoid of interest it is certainly worth while to see this great stretch of timbered country, and few are likely to make the ascent and be disappointed with the view.

The ornithology of the lake has been partially studied by Mr. Silloway, who has a special report on the birds of the region. This will be issued separately later. Mr. Whitford has made a comprehensive study of the forest region about the lake. He has travelled through many miles of pathless woods guided by the compass. Several weeks have been spent in this work. The result will be of great value to students of the laboratory, and to students of forestry in general. His report will no doubt be published in full by the Bureau of Forestry.

It would be premature to make report of the entomostraca in the lake. The material consists of collections made during two different summers. In 1900 the writer spent several days at the lake. Pumpings were made from different depths, and a number of surface hauls made. In 1902 Mr. Silloway made almost daily collections during the month of June. The work of Forbes has been previously referred to.

Shell life in the lake seems to be scarce. No more than six species have been found in the water or along shore. They are as follows:

Planorbis trivolvis Say. At the lower end they seemed rather common. At the upper end, in the swamp, Mr. Silloway secured a good series, and reported them abundant.

Limnaea stgnalis, L. A few specimens of this large shell were picked up at the lower end. At the upper end they were common in the swampy bay, where Mr. Silloway gathered a moderate quantity.

Limnaea emarginata, Say. Specimens very closely related to those found at McDonald lake, described as variety montana, were taken sparingly.

Physa heterostropha, Say. A few were picked up along shore at the lower end. They were all dead, and no doubt were washed in from the nearby marshes.

Sphaerium partumeium, Say. A single dead specimen was taken along shore at the lower end. The statement made for the preceding species will no doubt apply to this.

Pyramidula strigosa var. cooperi, W. G. B. This land species was taken abundantly by Mr. Silloway, who reported it in great quantities during the wet month of June. It is interesting to note that it does not seem to be mixed with **P. solitaria**, so abundant on the opposite side of the Mission range.

The annual rise and fall of the lake does not seem to be more than a few feet. The area drained is almost entirely wooded. The snow is therefore held back in spring by the timber, which prevents the sun from taking it off rapidly. The only water of any importance entering lake is the river, which enters the bay toward the upper end as previously mentioned. On the east one small creek and several rivulets carry a few second feet of water. There are no streams worth mentioning coming from the Mission range into the lake. The entire shore along the Swan range at the upper end is springy. A few inches below the surface at almost any point reveals cold water, seepage from the hills, no doubt. The amount of water brought to the lake from this source is not known. The river at the inlet and outlet have not as yet been measured, and the flow cannot therefore be given.

Air currents in the region of Swan lake are pronounced, and merit notice. Lying in a cradle between two mountain ranges, its surface must be stirred by every mountain breeze. As has been mentioned, the higher slopes of both ranges are south of the lake. In summer these higher summits contain the greater portion of snow, while the peaks nearer the lake are mostly bare, save on the north and east. During the day these rock summits become heated, the warm air rising as the rocks become more and more affected by the sun. A current of air is therefore put in motion up the lake. This is usually felt during the day in summer. At dusk, after the sun has set, the reverse takes place. The rocks along the mountain ranges which during the day have been warm now cool rapidly. The cool air is heavy, and flows down the mountain slopes toward the center of the valley. Down this it moves. As it crosses the lake from the upper to the lower end its movement may be followed by the ripples on the surface. Occasionally this is intensified by a breeze, which may be occasioned in the same manner by extremes of heat, but which probably has some other origin. The result is a strong wind, perhaps sufficient to be called a gale, which piles up the water at the narow outlet into waves of much force for so small a body of water.

The lake is free from driftwood. The currents just mentined no doubt carry all the drift down lake to the outlet. From this place it may easily pass down the river and on to Flathead lake.

From its beautiful location in the heart of the mountains Swan lake will no doubt become a resort for those who wish a rest from mental labors. It is primitively wild. Game abounds. The lake is large enough for extensive boating with small craft. The waters are clear and cool. Fishing is good. Mountain climbing may be indulged in to almost any extent. The lower peaks near the lake may be scaled, or the mountaineer may go south a few miles and find summits reaching to 10,000 feet. The region is a bontanist's paradise. In the swamp the entomologist will find a rich field. No doubt many new species await the collector. Artists may find ample scope for the brush, and the weary brain may find a haven of almost complete rest if such is desired.

The Swan Range of the Kootenai Mountains.

Several excursions have been made into the Swan range in different years. In 1901, Dr. MacDougal, Mr. Harris, Mr. Ricker, Mr. Silloway and the writer shouldered packs and started over the trail to Haystack. We passed along the south face of this about third way up, and northeast to Silloway mountain. The second day Mr. Ricker and Mr. Silloway returned to camp. The remaining three passed entirely around the head of Wolf creek, ascended Craig mountain, followed its long ridge to the northern end, and descended through the woods to camp the third day without mishap.

The trail thinned out and disappeared early in the day. The slope was steep. The blazing July sun on the south side of the mountain was blistering hot. The way was almost barred by dense growth of rock maple, alder, mountain ash, New Jersey tea and Menziesii scrub. This growth was bent downward by many heavy and sliding snows. In its effort to straighten the shrubby vegetation had become a tangled mass, exceedingly difficult to penetrate.

From nine in the morning, when this scrub growth was first encountered, until six in the evening we worried through this dense and tangled shrubbery. Excessive thirst drove us to a descent to the creek at this time, as our canteens were long since empty. After a cool and refreshing draught the brush was again entered. It was worse than ever. It was impossible to see more than a few feet ahead, and it was often necessary to crawl on hands and knees to get through. Most of the time the head man was poking his gun between bent bushes with one hand and with the other trying to force the stems apart so as to slip through. Of course the others followed. The lead man was soon tired out with the threshing round he received and was relieved by another, and so on. It was the most trying, soul stirring, temper distracting and abominable place the writer has ever had the bad fortune to be in. Guns, packs, and other paraphernalia made progress so slow as to be very disheartening. Some of the boys wanted to stop and sleep on the brush. But we pushed on. About nine in the evening we stopped on a large flat rock, fifty feet above the stream, and 1,600 feet below the ridge we hoped to reach by night. So tired were we that we threw ourselves down to rest without removing the packs. After a meal remembered not by the abundance or variety of food, but by the fact that it was very good, we crawled into our sleeping bags around the campfire for a night's rest.

The next morning we were off before half past six. The slope was steep, and smoothed annually by spring avalanches. We reached the ridge summit at 9, prospected the three ridges to the mountain, as also the lake. As stated, two of the party returned from here to camp. The other three followed the ridge southward, skirted Actomys on the west, passed over some rocky cliffs into the pass of faulted rock between Arctomys and Craig, spending the night between huge snowbanks. Our supper consisted of emergency rations only. It was very palatable and satisfying. After the meal I skinned a ground hog I had previously shot and buried the carcass in the sonw to try the meat for breakfast.

Breakfast consisted of emergency rations and ground hog. The latter was so tough we had to chew it as we went to save time, and little of it could be eaten. Old woodchuck from alpine regions is not recommended as a palatable diet.

Passage across the rock ribbed pass was interesting. It was up and down the faulted rock, with a tendency upward. Wearily the ascent of Craig mountain was made. After a rest the ridge was followed until the descent to camp began in earnest. After entering the dense timber nothing could be seen beyond the immediate foreground. During the afternoon our noise interrupted a bear at his feast of berries. Of course he immediately decamped. We arrived at camp tired and hungry, late in the evening.

A few weeks later, in the middle of August, Dr. MacDougal and the writer, accompanied by an old trapper, made an expedition into the Swan range over Aeneas trail. This time we took a pack horse to carry our luggage. A week was spent in gathering material. As we were not familiar with the region some time was lost in getting into localities desired. Ample collections of plants were made. The trip brings back only pleasant memories of beautiful moonlight nights, camps in delightful spots, and other reminiscences of similar nature. Of course there was rain, and hail, and sleet, and slippery trail with poor footing, long and hard tramps with good load to carry, but all these are forgotten.

Necessity demanded that many of the peaks and lakes be named. When collections are made they must be located. This will be apparent The following pages give some of the names applied and the reason for each. No excuse is offered for these. They are as appropriate as any, unless it be some local characteristic which would be especially noticeable.

From the laboratory to the base of the mountains eastward the distance is twelve to fourteen miles. There is a good wagon road to within three miles of the base of the range, but it is a few miles farther by this road than by the trail. Starting from the top of the hill at the bend of the river north of the laboratory one may take a well worn trail through the woods to Nigger Prairie, from there following the wagon road, going either to Shultz's cabin, the end of one road, or to Rost lake, the end of another road, or to Swan lake, where the road ends in that direction.

The ascent of MacDougal Peak is made from Shultz's cabin; the ascent of Silloway mountain, Craig mountain or Haystack is made from Rost lake. The mountains farther south in the range are reached from the Swan lake region.

From Shultz's cabin the old Aeneas trail leads to the summit of the ridge, passing through a notch in the ridge, then to the left along the east slope in a direction northeast, and on to the South Fork of Flathead river. The trail is well worn and easily followed. It is full of snow until July, and in the middle of August the trail is partially buried by drifts. Camp may be made at the end of the wagon road at Schultz's where there is water and pasture.

From the lower end of Rost lake a trail leads through the timber to the mountain side, evidently a game and huckleberry trail. At the base of the mountain it thins out and finally disappears. The trail may be found by following the wagon road to the first house on the east side. Cross the little meadow toward the mountain and the trail may be seen leading off into the woods. When it forks take the right hand fork. The mountain slope has no trail. On the canyon side it is very bad going. The route up over the summit of Haystack is preferable to the trip up the canyon. Silloway peak is the bald mountain east of the first summit, which is Haystack. Craig mountain is across the canyon south from Haystack. Arctomys is next southeast of Silloway, connected with Silloway and Craig mountains by low passes.

By passing up the east side of the lake to the second cabin another trail may be found. This trail leads through the woods to the pass between the southern or pointed peak of Haystack and the next one north, Hopkins, and over or through this pass to Silloway peak.

At the upper end of Rost lake on the west is a cabin. From this center several trails lead out. The main trail leads into the timber north, and by blazes may be followed to Shultz's cabin, where the Aeneas or Blackfoot trail is to be taken. About fifteen minutes walk after leaving the cabin brings one to a fork with a branch trail leading to the right. This branch goes to a series of bear traps. Farther on a branch to the left takes one up to the very foot of Haystack to trapper's cabin. By consulting Fig. 3, page 148, the above details may be easily made out.

At the foot of Swan lake if one has a wagon and wishes to go farther he must leave it. A well worn trail for pack horses may be followed up the east side of the lake. Or one may take a boat up the lake about twelve miles and then take the trail. This trail is kept open by forest rangers, and leads up Swan river to the divide between it and the Big Blackfoot, and down this to any point along the river.

In winter when the snow is deep and snowshoes are used the passage to the South Fork country is up Fulton creek and through the low pass between MacDougal peak and Estey. This pass is shown in the foreground of Plate XXXI, and is known as the Snow Shoe pass and trail. It is impracticable in the summer time on account of the dense brush.

The trails mentioned above are from the writer's personal knowledge. By consulting the pages elsewhere trails into the Mission range may be located.

The trail from Shultz's cabin to the foot of the mountain is well worn, and shows much usage. Up the mountain side it is tortuous, winding, and very irregular. It winds back and forth in the timber, unnecessarily increasing the distance, in some cases actually losing ascent as one proceeds upward. As one traveler on the trail expressed it, the trail gives the impression of having been made by a drunken squaw, who had no idea of where she was going, and who wandered around in the woods. But it is no easy matter to find a way through a densely timbered region, with no view out, and to strike the main slope without more or less wandering is practically impossible, except when the view is open, which is rarely the case. But when the trail reaches the mountain slope and takes the ridge it goes directly up. The ascent is easy, but in several places quite steep. The first summit is at an altitude of 6,750 feet, approximately. This summit is the end of a spur from the main peak, connected with it by a long ridge. Between this summit and the main ridge farther east is a large amphitheater, wood mostly with black pine, and filled with snow until middle July. The trail follows the spur ridge for some distance, then drops off into the amphitheater and across to the notch in the ridge to the east, passing over much large and loose talus. It may be of value to travelers over the pass to know that just before making the steep ascent to the notch, in middle or late summer when the snow is gone, water may be had in abundance by following the dry water course down a few rods, where a large spring affords abundance of water. As this is the only water between the foot of the mountain at starting and the first lake beyond the notch its location in late summer is very important to mountain climbers.

Passing through the notch the trail thins out, and for a short distance is not easy to follow. It turns to the left. By following the base of the summit ridge it is not difficult to find it a few hundred yards ahead.

In ascending MacDougal peak the mountaineer does not follow the trail when it leaves the ridge before mentioned, although he may do so and later follow up the ridge from the notch. Instead the ridge is followed, until late in summer over snow banks. When the main ridge is reached, it is followed to the summit. On the eastern face of the ridge is an immense snow and ice mass which remains all summer, and which seems to have a little glacial movement. At the foot of the glacier is a small lake which is named Blue lake on account of the color of the water, which appears deep blue.

On the summit, altitude 7,725 is a U. S. G. S. triangulation stone monument. The view from this summit is superb, and the geology of the region may be studied to good advantage. Without duplicating descriptions the reader is referred to Plate XXXVII, which gives the view west and southwest, with explanations; to Plate XXXVIII, showing the backbone of the continent, the view being to the northeast. The mountain in the foreground is Dodge mountain, named in honor of Wm. E. Dodge, who has made large contributions toward the study of Montana flora; Plate XXXI shows the view to the southeast. Silloway peak is the double peak. Craig mountain is on the right. Silloway lake lies behind the double peak. Wolf creek takes its source in the depression seen between Silloway peak and Craig mountain.

In Plate XXXI four lakes are visible. In the foreground the larger one is MacDougal lake. The outlet is to the right, through Fulton creek.

On the summit of MacDougal peak were found large numbers of ladybird beetles, **Hippocampus 13-signata,** found on most of the summits with loose rock from Washington far east into Montana.

Dodge mountain has been traversed from end to end, and many rare botanical specimens secured.

Between Dodge mountain and Silloway peak is a deep canyon with steep sides. This is recognized as Wilson creek. On the northeastern side of Dodge mountain, low down, is a beautiful lake, Dodge lake. Between Dodge mountain and the slope leading down from MacDougal peak, northwest of Dodge mountain, is another lake, Sylvan lake. Its banks are abrupt on all sides except the outlet. In the wooded bench to the northeast of Sylvan lake may be found many smaller lakes, to which no names have been given.

From the notch before mentioned and from the crest of the ridge leading up to MacDougal peak a bench slopes off eastward. This is a beautiful park like slope, with a carpet of alpine flowers and beautiful though dwarfed trees. This is called Sylvan slope. The trail before mentioned traverses it for some distance, hugging the base of the ridges.

Sylvan slope is wooded by the same trees that grow on the higher summits. The two most abundant trees are the white-bark pine, **Pinus albicaulis** Engl., and the Alpine fir, **Abies lasiocarpa** Hook. In protected places these trees grow to a beautiful shape. They are usually limbed to the ground, the larger and longer limbs at the base. Succeeding limbs taper gradually to the summit or tip of the tree. The limbs are bent downward with the weight of snow during many winters. In most cases they make an acute angle with the trunk of the tree.

On the exposed slopes and summits the trees are torn and twisted, stunted and gnarled, almost limbless, with tops broken off, and roots exposed. They are subject to extremes of heat and cold, moisture and drouth.

Strong gales from different directions sweep the summits and ridges. The winds blow with fury. They turn and twist the trunks until they are misshapen and unsightly. But still the trees survive. Their mangled limbs and broken trunks are silent witnesses to the fierce struggle through which they have passed.

The contrast between the exposed and protected trees is very great, as may be seen by consulting the plates. Sylvan slope is an ideal region. To spend a night there is to have the feeling of perfect rest and peace. No one can forget the beautiful trees, the marked contrast between flowers and snow, water and sky, lakes and cliffs, roaring water falls and murmuring pines, barren rocks and mossy banks, or can blot from memory the magnificence of a night when the moon is at is full and the sky is clear.

There are many of these benches, made by faulting in the uplift, between the crest and the South Fork river. They are long, steep, and heavily timbered, enclosing many lakes, and holding large masses of snow. Sylvan lake is reached by passing down the slope eastward immediately after passing through the notch in the main ridge. It is yet unexplored zoologically.

The trail follows Sylvan slope for some distance, a couple of hours walk. Even in July and August there are large snow banks in the ravines along the slope. An admirable oportunity for study of alpine flora is presented in this field. The trail then drops abruptly over the ridges and down a very steep bank for more than a thousand feet to another beautiful lake. This we called Placid lake.

Placid lake is hemmed in on all sides by abrupt slopes, save toward the southeast, in which direction the small stream leaving the lake flows toward the South Fork river. At the upper end of the lake is a small and densely wooded flat. The trees are beautifully formed, tapering to a point, tall and stately. It is a fine place for camping, and game appears to be abundant in all the timbered slopes and valleys. The trail is traveled very rarely, and the life of the lake and adjacent territory is unknown, save from the collections made at the time of our visit, and which will be reported later. It appears that the Indians have made this a halting place in earlier days.

From Placid lake the trail ascends a ridge to the northeast, the ascent being about 800 feet. The view in every direction is very fine, and for this reason the ridge was named View ridge. At the time of our visit the vegetation was very luxuriant. A storm was approaching from the east, across the main Rockies, the backbone of the continent. Heavy clouds were rolling over the peaks, enveloping them one by one. It was a rare sight to stand at a distance and see the ranges slowly wrapped in a mantle of mist. Behind, almost a thousand feet below, was to be seen Placid lake. Beyond it was the main ridge of the Swan range; to the left was Dodge mountain, bold and rugged. Between View ridge and Dodge mountain is a creek of considerable size, unnamed. This creek we called Trail creek, because the old trail is not far from it during its entire course, and crosses the creek again before it flows into the South Fork river. Let us again follow the trail, down View ridge; between it and the next ridge is another beautiful lake, larger than Placid lake, and more interesting. The trail passes close by the lake. The shores of the lake have no doubt been the camping place of Indians, as evidenced by the large number of tepee poles. The age of these poles shows that they were used many years ago. Game signs are abundant. Collecting is good, but owing to lack of facilities the life of the lake was not examined. From this region many rare botanical specimens were secured.

Again the trail makes the ascent of a ridge, to the northeast. It follows the summit of the ridge southeastward, and keeps on the ridge until it drops off to the South Fork river. For this reason the ridge was named Trail ridge. The lake is likewise named Trail lake. The names Trail creek, Trail lake, and Trail ridge seem very appropriate. The waters from Trail lake flow in the opposite direction from those of Placid lake, and reach the South Fork river by an unknown and unexplored creek. The waters of Placid lake flow into Trail creek. Trail creek originates in the snow banks and glacier on MacDougal peak.

The view from Trail ridge is excelled only by that from View ridge, and the territory one may inspect is considerable. The ridges and valleys are well wooded, and to leave the ridge is to plunge into timber where a view of the surrounding country is seldom had.

Table of Altitudes.

The altitudes below are from aneroid readings. The barometer is of English make, compensated, reading to 20,000 feet. It has been thoroughly tested, and the readings, although uncorrected for atmospheric variations, are not far from correct. The altitudes are given for the benefit of those who may be traveling in the regions mentioned.

Kalispell, correct	2,946
Flathead Lake	2,916
Biological Station (approximate)	2,935
Rost Lake	3,200
Summit of Ridge on Silloway Peak, immediately above and west of Silloway Lake	7,350
Wolf Creek at base of preceding ridge	5,450
Silloway Peak, highest	7,725
Silloway Peak, second summit	7,625
Saddle, between Silloway and Arctomys	6,800
Pass at head of Wolf Creek	6,550
Craig Mountain, highest	7,425
Shultz's cabin	3,225
Water, trail above Shultz's	4,000
First Summit, MacDougal Peak	6,750
MacDougal Peak	7,725
Notch, where trail passes	7,075
Dodge Mountain	7,425
Sylvan Lake	6,450
Peak between MacDougal and Dodge	7,400
Placid Lake	5,950
Trail strikes View Ridge at	6,850
View Ridge, highest,	7,450
Trail lake	6,200
Trail strikes Trail Ridge at	6,750
Trail Ridge, summit	6,950
Sin-yale-a-min Lake	3,800
Sin-yale-a-min Mountain	9,250
McDonald Lake	3,300
McDonald Peak, west summit	9,500
Post Creek at wagon road	2,300
Summit of Moraine at Flathead Lake	3,400

MONTANA SHELLS.

The following list comprises the land and fresh water shells reported from the state. The list contains 60 species and varieties, 25 of which have been collected west of the main range of the Rocky Mountains, 42 east of the range. This makes a list of seven found on both sides of the Rocky mountains.

The collection east of the range was made largely by Homer Squyer, of Wibaux, recorded in Nautilus, Vol. VIII, pp. 63-65. At the time the record was made the town was called Mingusville, since changed to Wibaux. The shells from Madison Lakes and Tobacco Root Mountains were collected by Earl Douglas and E. H. Murray. Those on the western slope were all collected by the writer.

The list certainly does not represent the entire mulluscan fauna of the state, and is given merely as a basis for work, so that those interested in these forms may be able to work intelligently. Residents of the state are invited to send to the writer shells from their localities, so as to aid in making a complete list.

Full information and notes regarding these shells are to be found in the articles mentioned in the appended Bibliography.

It will be observed that the shells collected are from extreme ends of the state, with a few only from the interior. As the state is about 600 miles long there is consequently an extensive area intervening between the two collecting fields which yet awaits study.

The writer is under many obligations to Dr. W. H. Dall, of the Smithsonian Institute, and Dr. H. A. Pilsbry, of the Philadelphia Academy of Science, for their valuable assistance, so freely and cheerfully given, in the determination of specimens.

PHYLUM MOLLUSCA.

Class LAMELLIBRANCHIATA.

Order Siphonata.

Family CYCLADIDAE.

Genus **Sphaerium.**

Sphaerium sulcatum Lam.; Wibaux.

Sphaerium partumeium Say; Daphnia Pond, Swan Lake.

Genus **Pisidium.**

Pisidium compressum Prime; Wibaux.

Order Asiphonata.

Family UNIONIDAE.

Genus **Anodonta.**

Anodonta plana Lea; young, Wibaux.

Anodonta ovata Lea; young, Wibaux.

Genus **Margaritana.**

Margaritana margaritifera Lea; Bitter Root River, Tributaries of Pend d'Oreille River.

Class GASTROPODA.

Subclass Euthyneura.

Order Pulmonata.

Suborder Stylommatophora.

(Superfamily **Holopoda.**)

Family HELICIDAE.

Subfamily **Helicinae** (vel Belogona.)

Genus **Vallonia,** Risso, 1826.

Vallonia gracilicosta Reinh.; Wibaux.

Vallonia gracilicosta Reinh., var. close to **costata** Say; Wibaux.

Vallonia perspectiva Sterki; Wibaux.

Vallonia pulchella Mull.; Wibaux.

Subfamily **Ploygyrinae** (vel Protogna.)

Genus **Polygrya** Say, 1818.

Polygyra albolabris Say. A single specimen, which I refer to this species, was sent from Lewistown by P. M. Silloway, while the proof was being read.

Polygyra devia, var. **hempnilli** W. G. B.; Missoula.

Polygyra townsendiana, var. **ptycophora** A. D. Br.; Flathead Indian Reservation, in Mission Valley and Mission Mountains.

Family PUPIDAE.

Genus **Pupa** Draparnand.

Pupa muscorum L.; Wibaux.

Pupa blandi Morse; Wibaux.

Pupa blandi Morse, var. **edentata;** one specimen, Wibaux.

Pupa syngenes Pilsbry; eight more or less perfect specimens, Wibaux.

Pupa holzingeri Sterki; Wibaux.

Pupa armifera Say; Wibaux.

Pupa pentodon Say; Wibaux.

Pupa decora Gld; Wibaux.

Genus **Vertigo** Draparnand.

Vertigo ovata Say; Wibaux.

Vertigo binneyana Sterki; Wibaux.

(Superfamily AULACAPODA Pilsbry.)

Family ZONITIDAE.

Subfamily **Zonitinae** Pilsbry.

Genus **Vitrea** Fitzinger.

Vitrea arborea Say; worn var., approaching **V. breweri** Newc. Wibaux.

Vitrea radiatula Alder; rare. Wibaux.

Genus **Conulus** Fitzinger, 1833.

Conulus fulvus Mull.; one specimen from Wibaux; a few from Missoula.

Subfamily **Ariophantinae** Pilsbry.

Genus **Zonitoides** Lehmann, 1862.

Zonitoides minusculus Binn.; Wibaux.

Zonitoides laeviusculus Sterki; close to vars. of **minuscula**; Wibaux.

Zonitoides conspectus Bland; Wibaux.

Zonitoides arboreus Say; sparingly along the Bitter Root River.

Family LIMACIDAE.

Genus **Agriolimax** Moerch, 1868.

Agriolimax campestris Binn., var. **montanus** Ing.; Missoula, Flathead Lake.

Family ENDODONTIDAE.

Subfamily **Endontinae** Pils.

Genus **Pyramidula** Fitzinger, 1833.

Subgenus **Patula** Held, 1837.

Pyramidula elrodi Pils.; Banks of McDonald Lake, Mission Mountains from 3,000 to 7,500 feet.

Pyramidula strigosa Gld.; Tobacco Root Mountains, Bitter Root Mountains.

Pyramidula strigosa Gld.; var. **cooperi** W. G. B.; Mission Mountains, banks of Flathead Lake, Swan range of the Kootenai Mountains.

Pyramidula strigosa Gld., var. **alpina**; Mission Mountains above 7,800 feet altitude.

Pyramidula solitaria Say.; Missoula; Mission Mountains from 2,300 to 7,500 feet.

Subgenus **Gonyodiscus** Fitz.

Pyramidula striatella Anth.; Wibaux; a few from Missoula.

(Superfamily ELASMOGNATHA.)

Family SUCCINEIDAE.

Genus **Succinea** Drap.

(Amphibinae.)

Succinea avara Say; Wibaux.

Succinea obliqua Say; Wibaux.

Succinea grosvenorii Lea; Wibaux.

Succinea nuttalliana Lea; Flathead Lake.

Family LIMNAEIDAE.

Genus **Limnaea.**

Limnaea palustris Mull.; Wibaux, Flathead Lake, Swan Lake, Madison Lakes, Missoula.

Limnaea bulimoides Lea; Wibaux.

Limnaea humilis Say; Wibaux.

Limnaea caperata Say; Wibaux.

Limnaea stagnalis L., var. **appressa** Say; Bitter Root River, Swan Lake.

Limnaea nuttalliana Lea; Missoula.

Limnaea emarginata Say, var. **montana** Elrod; Sinyaleamin Lake and McDonald Lake in the Mission Mountains, Swan Lake.

Genus **Planorbis.**

Planorbis bicarinatus Say; Wibaux.

Planorbis lentus? Say; young shells only, Wibaux.

Planorbis parvus Say; Wibaux, Flathead Lake.

Planorbis umbilicatellus Cockrell (**P. umbilicatus** Taylor); Wibaux.

Planorbis trivolvis L.; Daphnia Pond, Flathead Lake, Sinyaleamin Lake, Swan Lake.

Family **ANCYLIDAE.**

Ancylus rivularia Say; one specimen from Wibaux.

Family **PHYSIDAE.**

Genus **Physa.**

Physa gyrina Say; young only, Wibaux, Missoula.

Physa ancillaria Say; Wibaux.

Physa heterostropha Say; Wibaux, Missoula.

Physa lordi Baird; Wibaux.

Physa ampullacea Gld., lakes in the Mission Mountains, Flathead Lake, Swan Lake.

Genus **Aplexa.**

Aplexa hypnorum; ponds along the Missoula River near Missoula.

The five species following are referred to in Pilsbry and Johnson's Catalogue of the Land Shells of America as probably occurring in Montana. The notes accompanying are quoted from the catalogue. The addition of these to the preceding list makes the total number of species and varieties in the state 65.

Vallonia costata montana Sterki, Rocky Mountains.

Vallonia cyclophorella Ancey, Washington to Montana.

Polygyra devia mullani (Bld. and Coop.), near Coeur d'Alene Mission, Coeur d'Alene Mountains, Idaho; west side of Bitter Root Mountains, Washington.

Polygyrella polygyrella (Bld. and Coop.), Coeur d'Alene Mountains, Idha. A variety **montanensis** Ancey is described from Deer Lodge Valley, Montana.

Succinea retusa Lea. Canada to Montana, southward to Georgia.

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ERRATA.

Page 119, fourth line from bottom, read bluebird for blubird.

Page 121, fifteenth line from top, read **alpina** for **montana.**

Page 149, twentieth line from top, read **Betula papyrifera** for Betula papyfera.

Page 163, twenty-first line from top, read Blackfeet for Blackfoot.

Page 122, second line from top, read Lace lake for Leash lake.

Page 147, ninth line from top, read **ponderosa** for **scopulorum.** At other places where reference is made to yellow pine **ponderosa** should be used instead of **scopulorum.**

Page 147, fourth paragraph from top, **Populus angustifolia** should read **Populus balsamifera** var. **candicans.** Dr. J. W. Blankinship of the Agricultural College expresses the opinion that this latter is the only species in the western part of the state.

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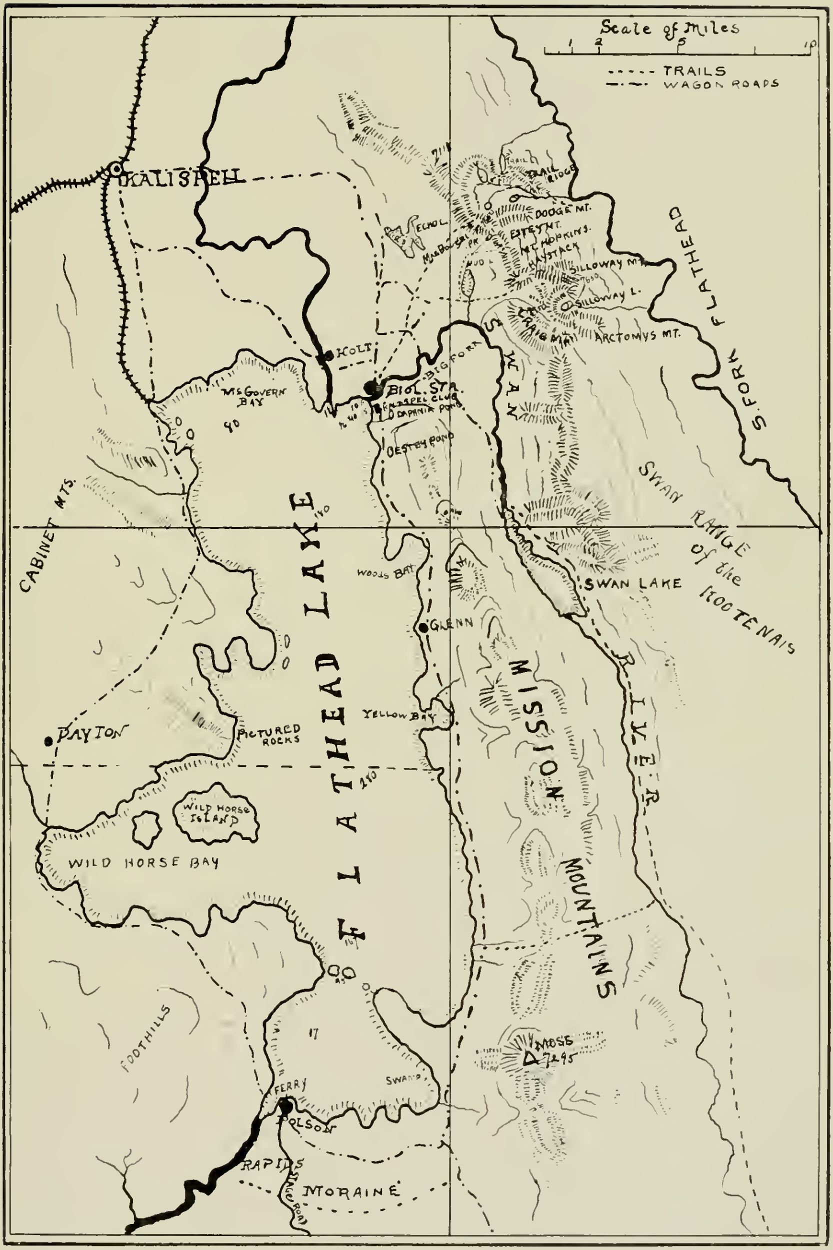
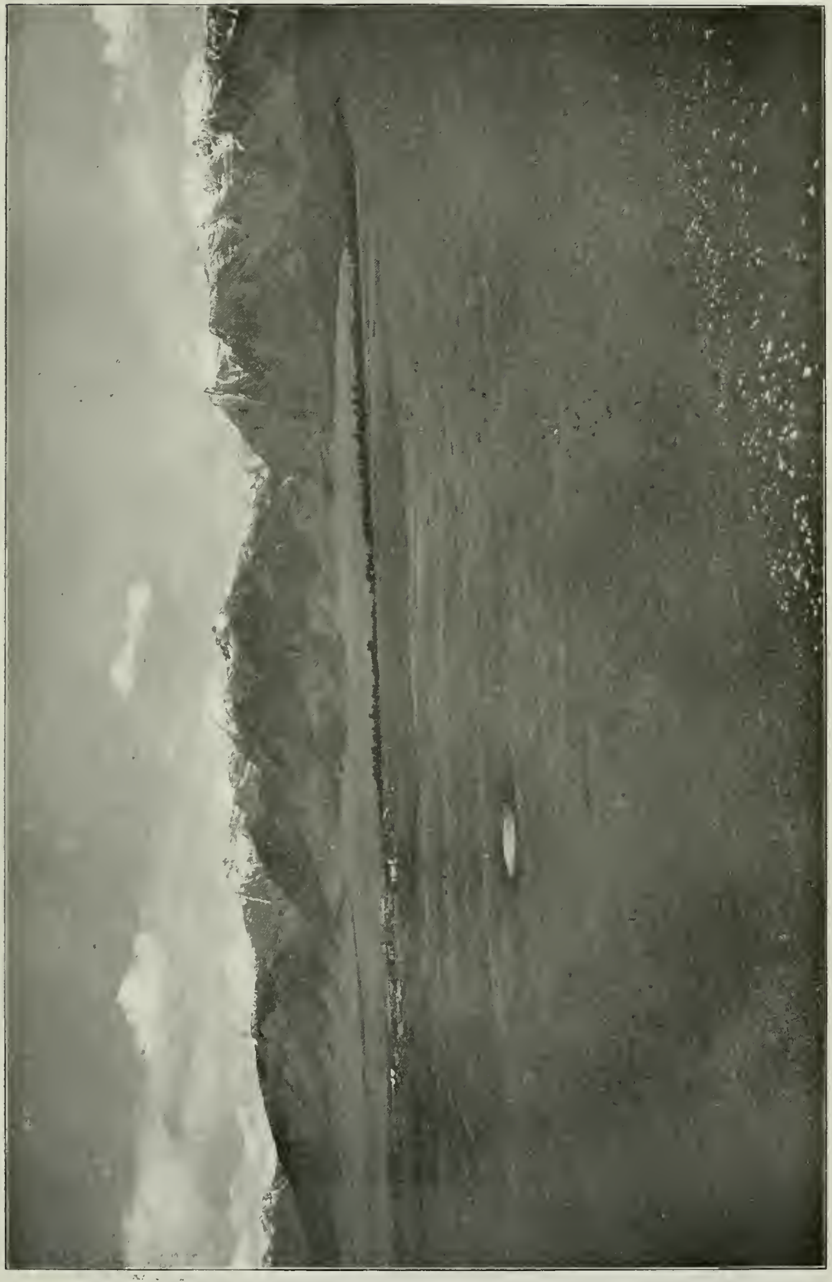
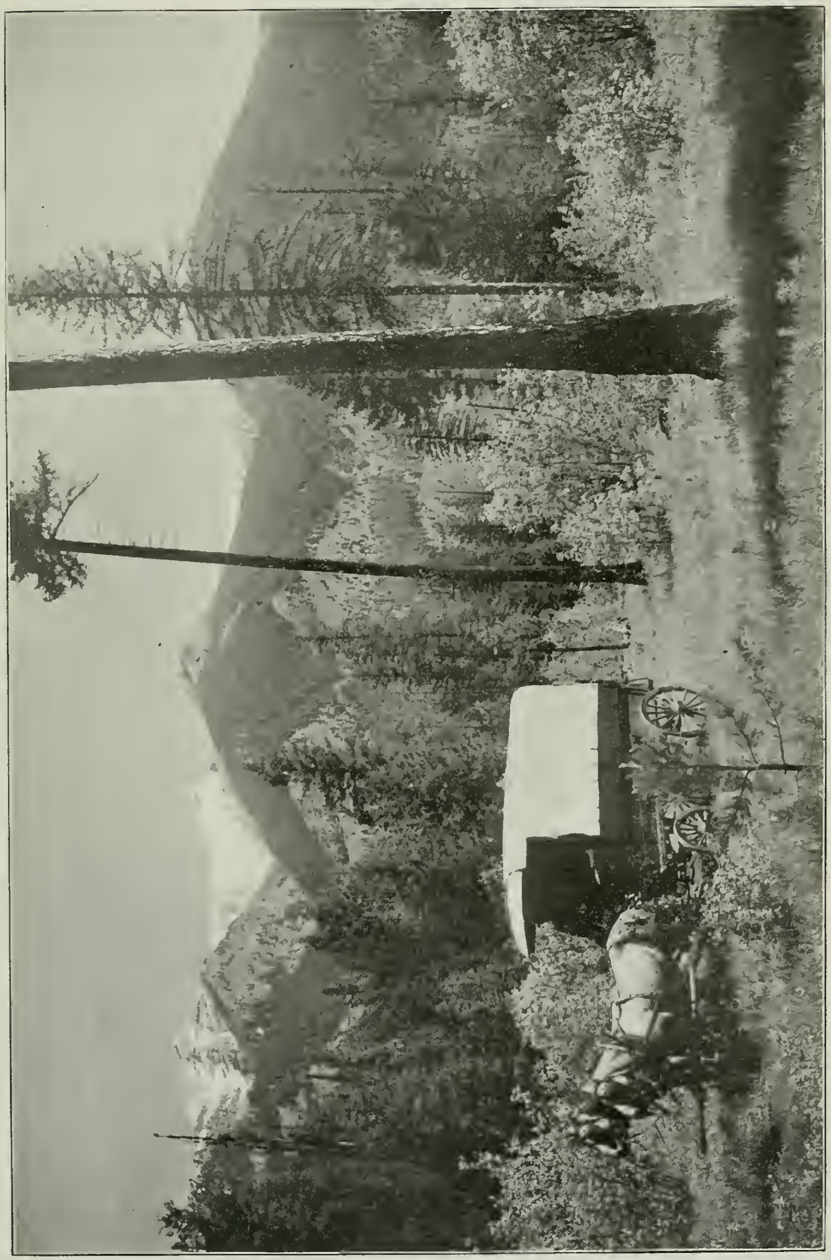

Scale of Miles
1
2
5
10
TRAILS
WAGON ROADS
KALISPELL
HOLT
BIOL. STA.
BIG FORK
ENDSPEL CLUB
DAPHNIA POND
DESTEY POND
ECHO L.
MACBOYER PK.
MUD L.
TRAIL
TRAIL RIDGE
DOOGE MT.
ESTEY MT.
MT. HOPKINS
HAYSTACK
SILLOWAY MT.
7650
SILLOWAY L.
CRAIG MT.
ARCTOMYS MT.
SWAN
S. FORK FLATHEAD
SWAN RANGE of the KOOTENAIS
SWAN LAKE
RIVER
MC GOVERN BAY
FLATHEAD LAKE
CABINET MTS.
WOODS BAY
GLENN
YELLOW BAY
MISSION MOUNTAINS
PAYTON
PICTURED ROCKS
WILD HORSE ISLAND
WILD HORSE BAY
FOOTHILLS
SWAMP
MOSS
7295
FERRY
POLSON
RAPIDS
STAGE ROAD
MORAINE

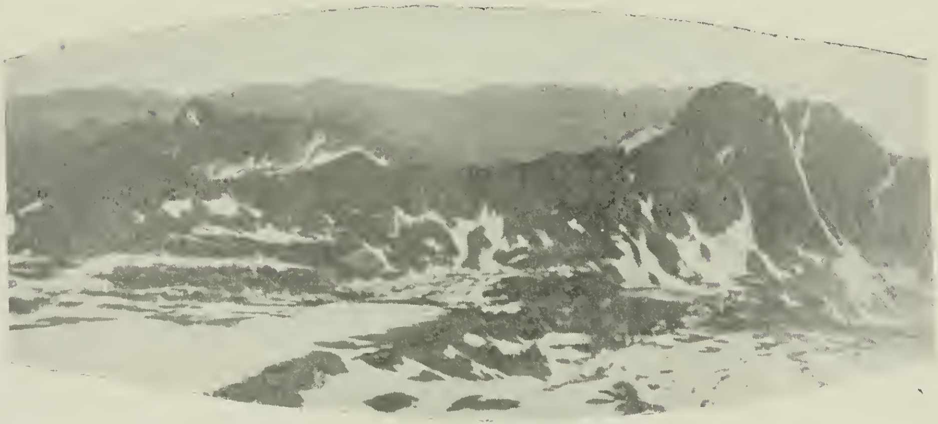
Map of Flathead Lake and adjacent region.



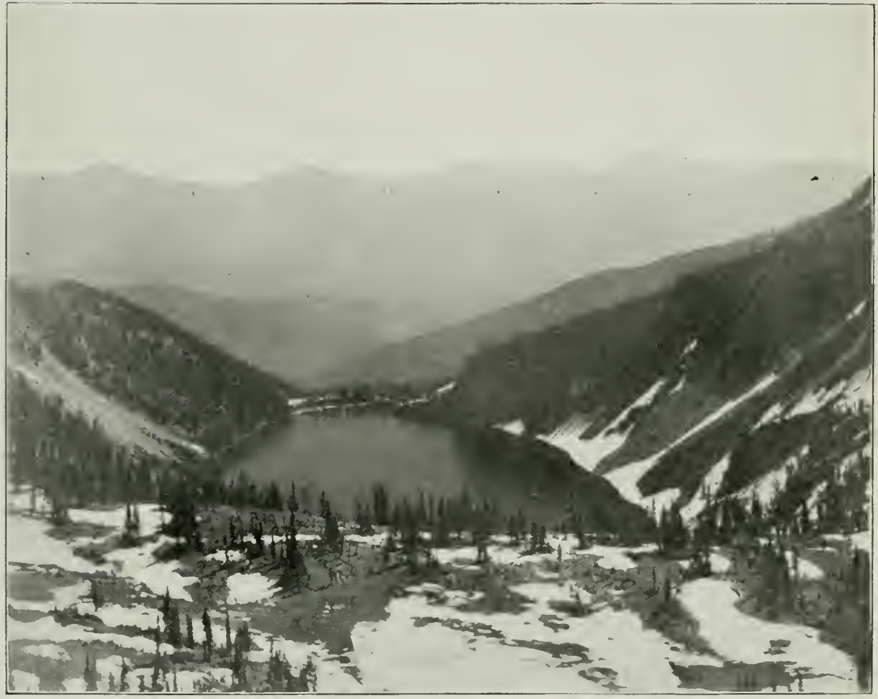
View of the southern end of the Mission Range from hill south of St. Ignatius, which is in the valley in the foreground. Mission Creek may be followed by the shrubbery growing along its banks. Photo by M. J. E.



Sinyaleamin Mountain, from the south. Photo by Morton J. Elrod. The view is north.

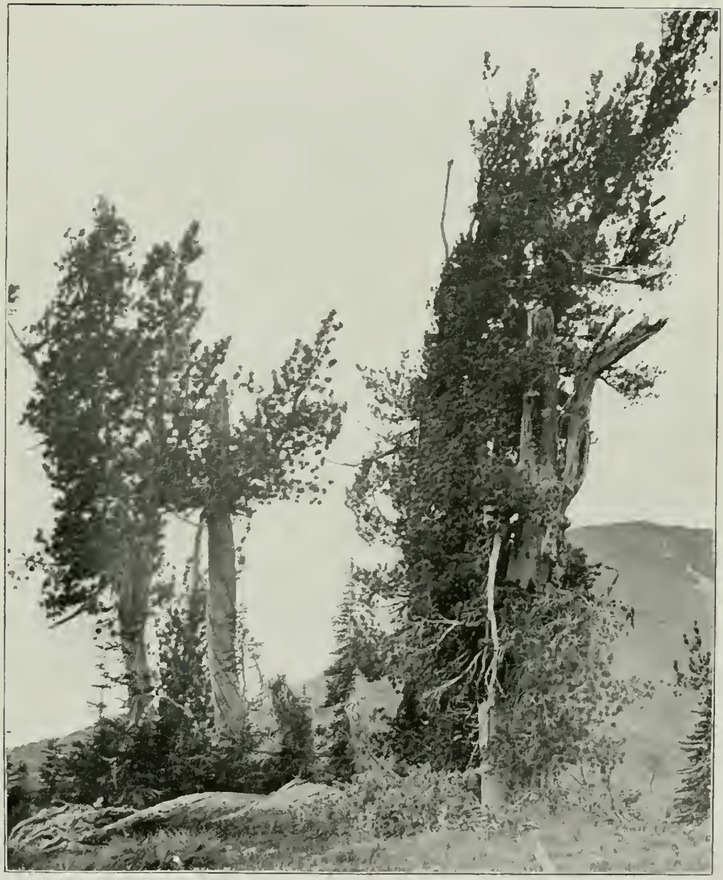


The Jocko Crags, seen from the summit of Sinyaleamin Mountain. The view is east. Snow Lake lies at the base of the mountain on the right. Photo by M. J. Elrod, July, 1900.

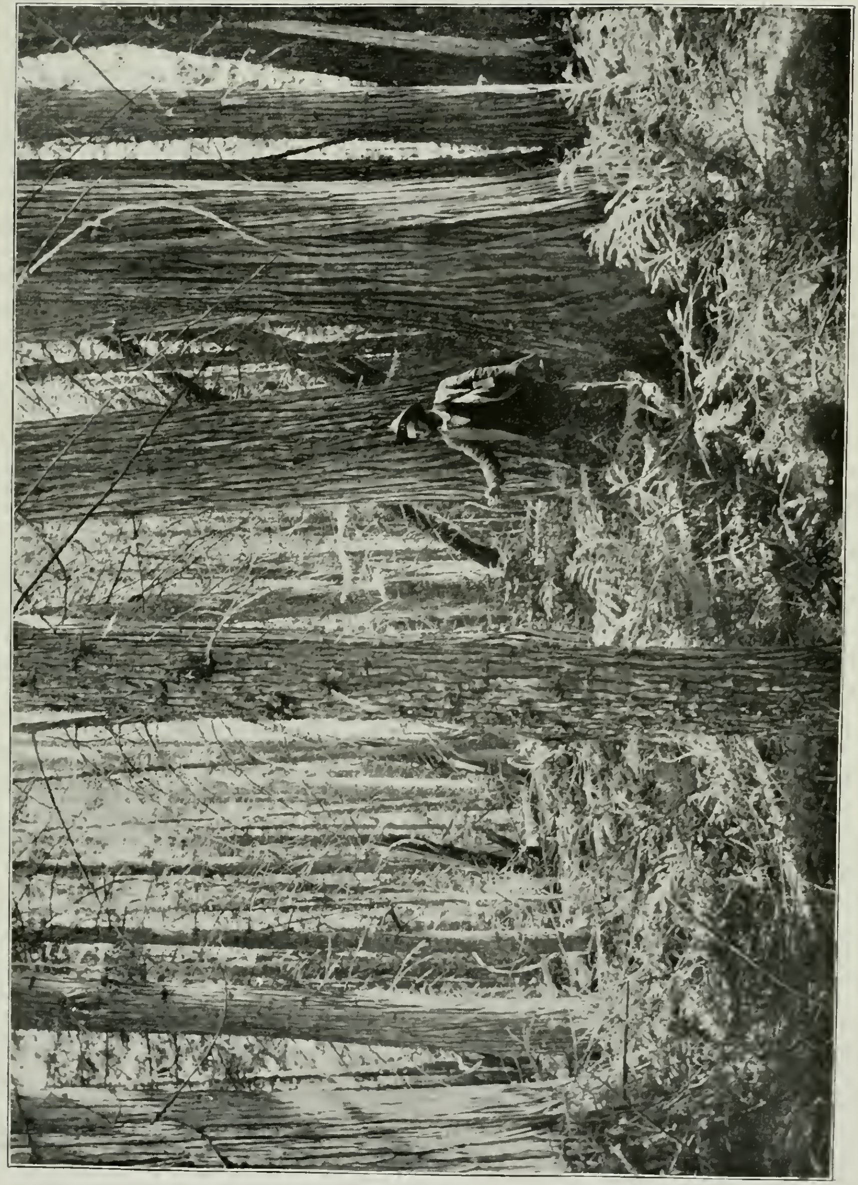


Silloway Lake from Silloway Peak, showing a typical alpine lake, enclosed on all sides, and fed by snow. The view is southeast. Taken early in July. Photo by Maurice Ricker.

Sinyaleamin Lake, from the southern side. The camp site is across the lake. Sinyaleamin Mountain beyond.
Photo by Prof. J. M. Hamilton.

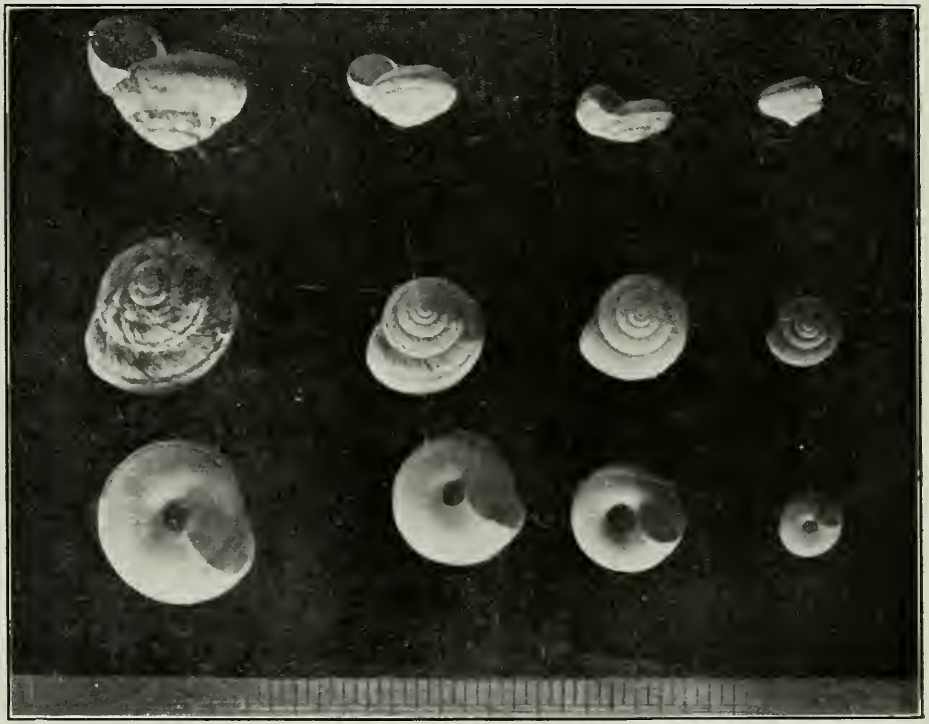


Pines on the slope of Sinyaleamin Mountain, at altitude of 7800 feet, showing the struggle they make for an existence. Photo by Prof. L. A. Youtz.

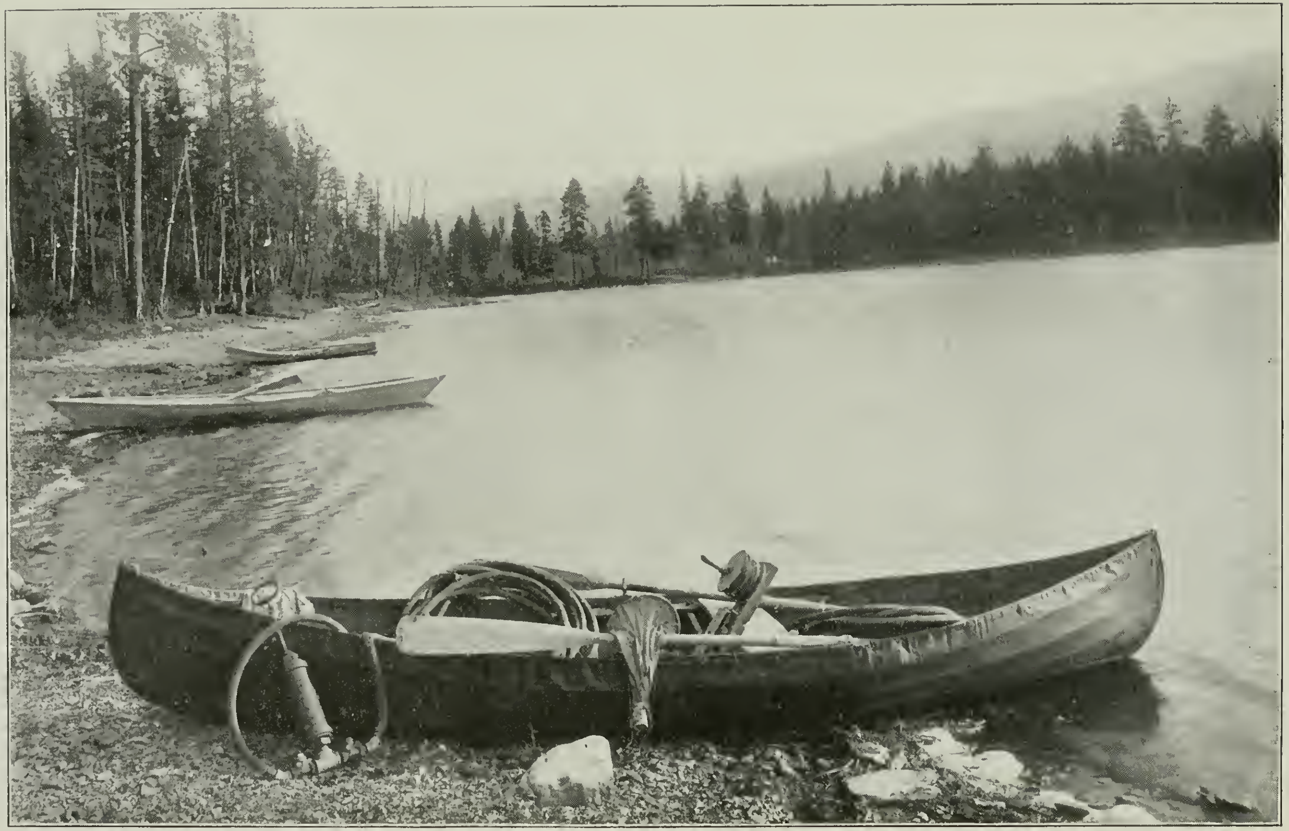


Arbor-vitæ forest at the inlet of Sinyaleamin Lake. Photo by J. M. Hamilton.

Cascade in Sinyaleamin Creek, a short distance above Sinyaleamin Lake. Photo by J. M. Hamilton.



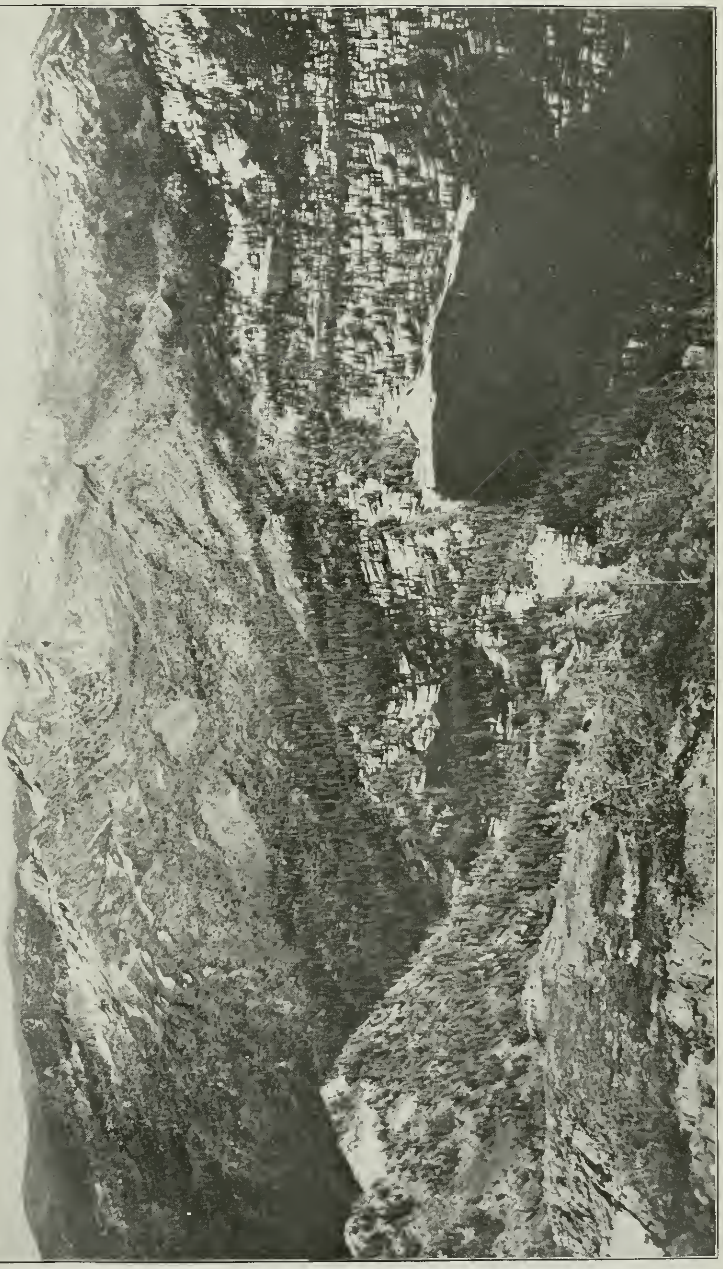
A series of shells showing the varieties of Pyramidula Strigosa due to high altitude. The largest, to the left, from McDonald Lake, altitude 3300 feet. The next size, from Tobacco Root Mountains, east of the main range. The third, from the Bitter Root Mountains, altitude 5000 feet. The smallest, from McDonald Peak, altitude 8000 feet. Photo by M. J. E.



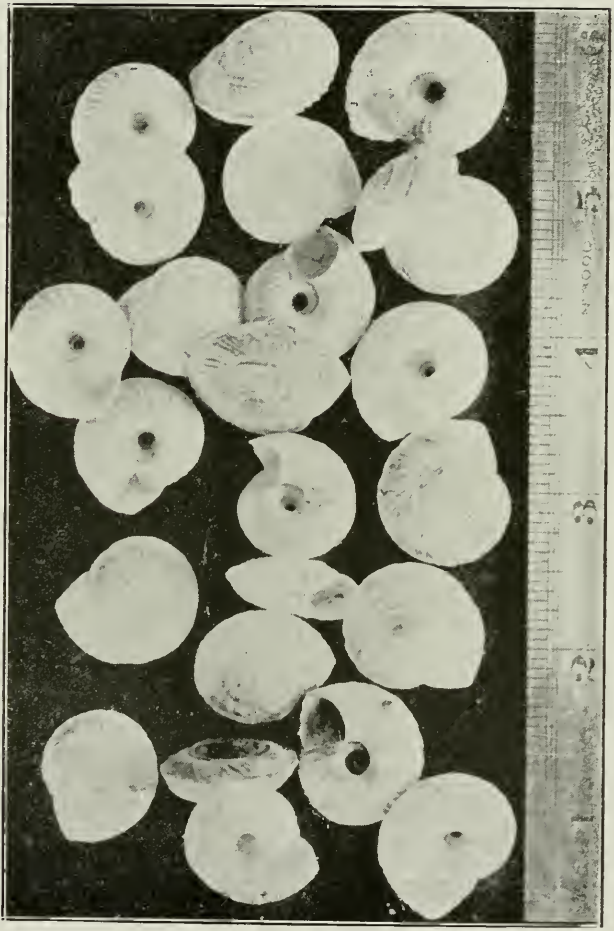
Canvas boat Daphnia loaded with apparatus and ready for service. By permission of the Am. Mic. Soc. Photo by M. J. E.
View is at the outlet of Swan Lake, looking down the river, north.

General view of McDonald Lake. McDonald Peak is on the right. The bluffs of Teton on the left. The view is from the outlet of the lake, looking east. By permission of the Amer. Mic. Soc. Photo by M. J. E.

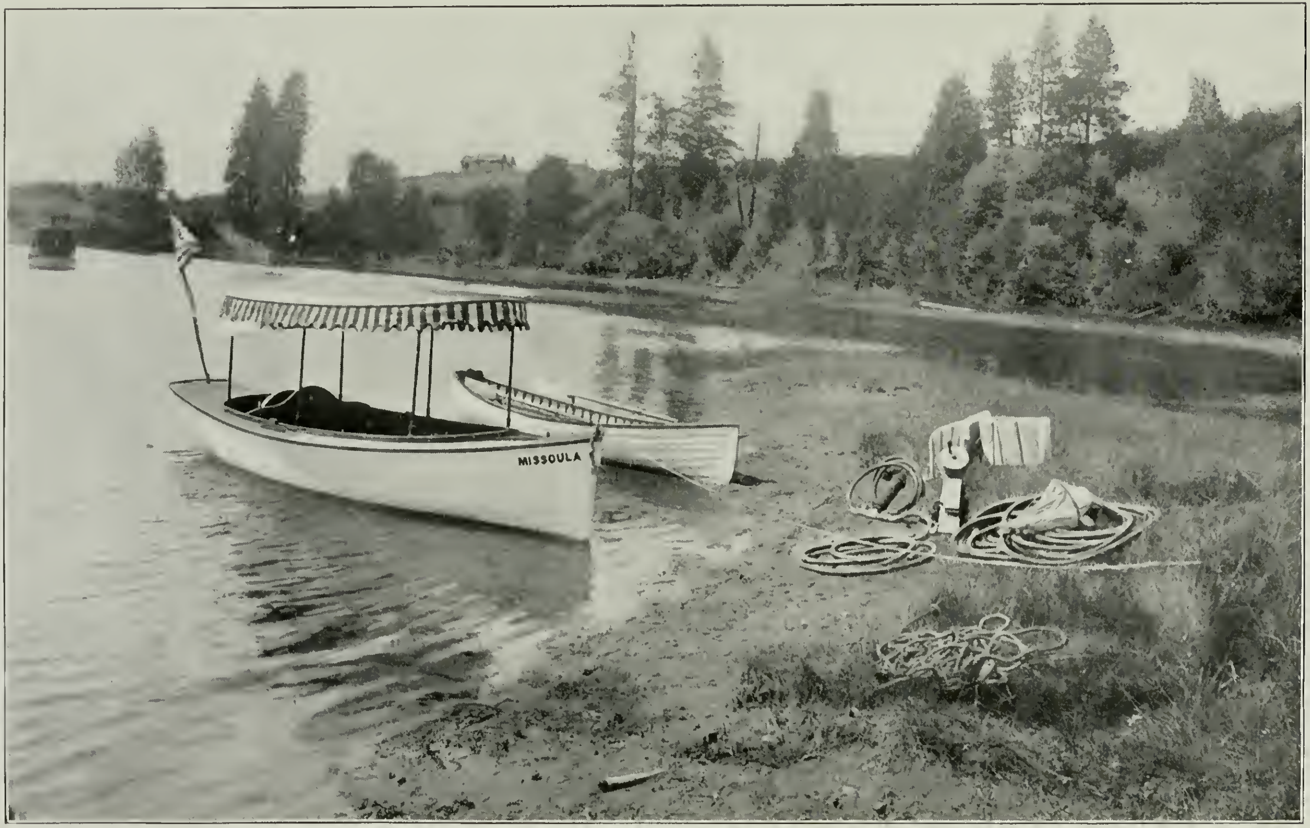
McDonald Lake, upper end, with McDonald Peak. Cedar forest in the foreground. The view is southeast. Photo by J. M. Hamilton



View southeast from MacDougal Peak. The lake in the foreground is MacDougal Lake. Silloway Peak is the double peak in the middle of the illustration. Craig Mountain is on the right in the distance. Photo by M. J. E.

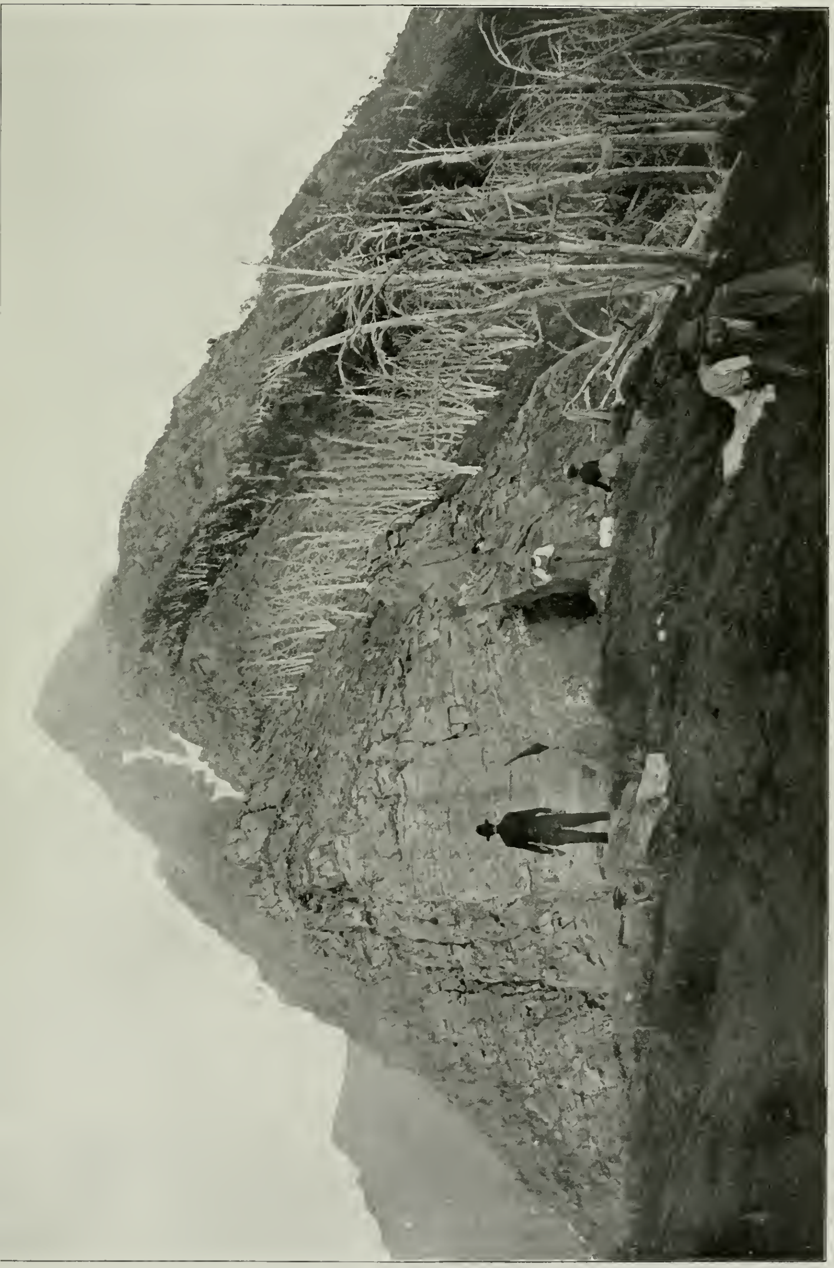


Pyramidula elrodi Pilsbry. From mountain slopes north of McDonald Lake. Photograph made at the University of Montana by Frances Maley.

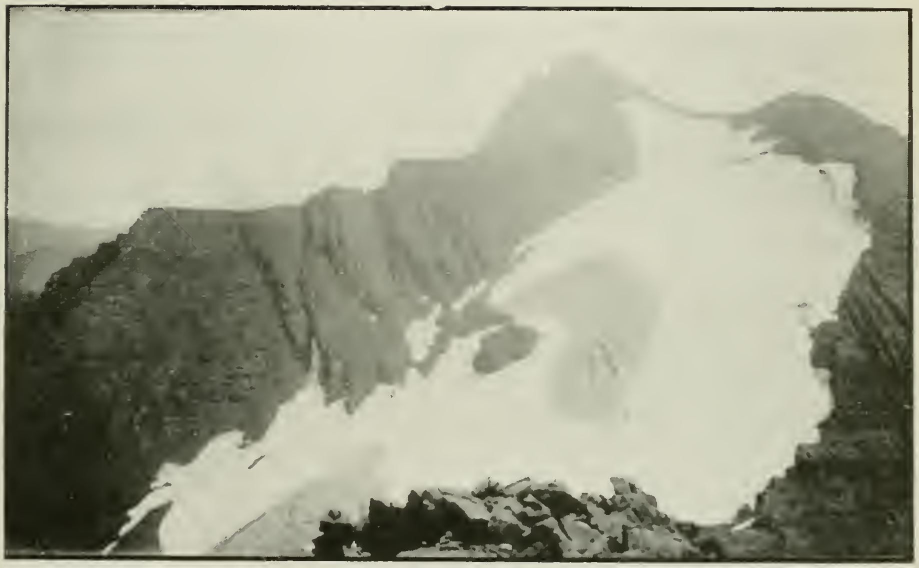


Equipment of the Station for work on the lake. The launch Missoula with rowboat Culex and equipment, in the harbor by the laboratory. By permission of the Amer. Mic. Soc. Photo by M. J. E.

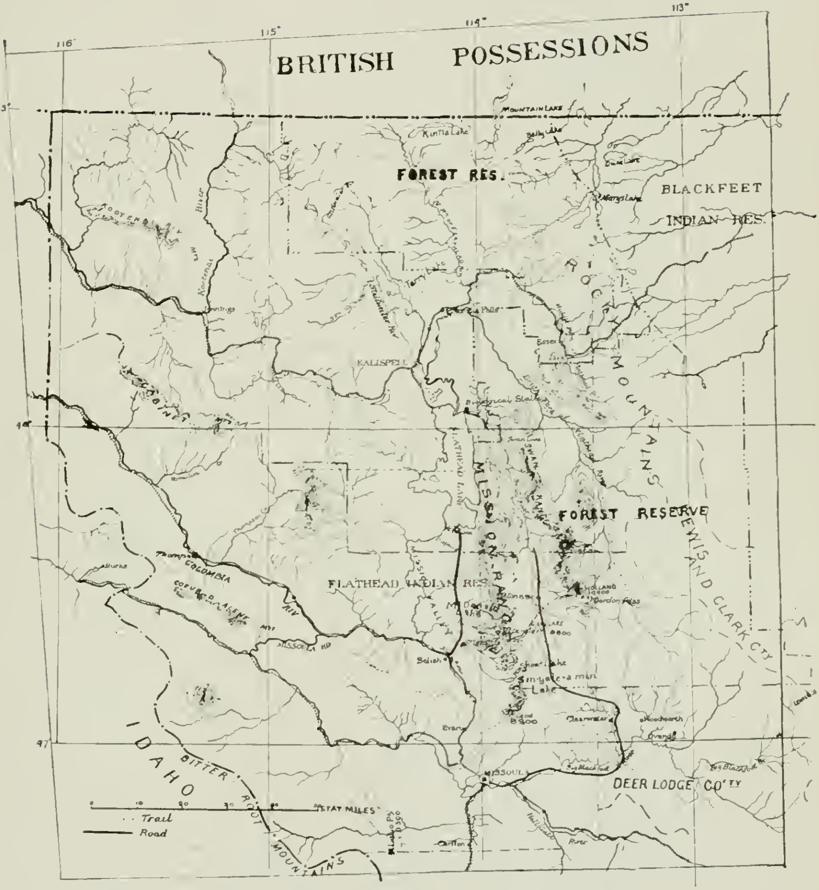
Plate XXXIV.



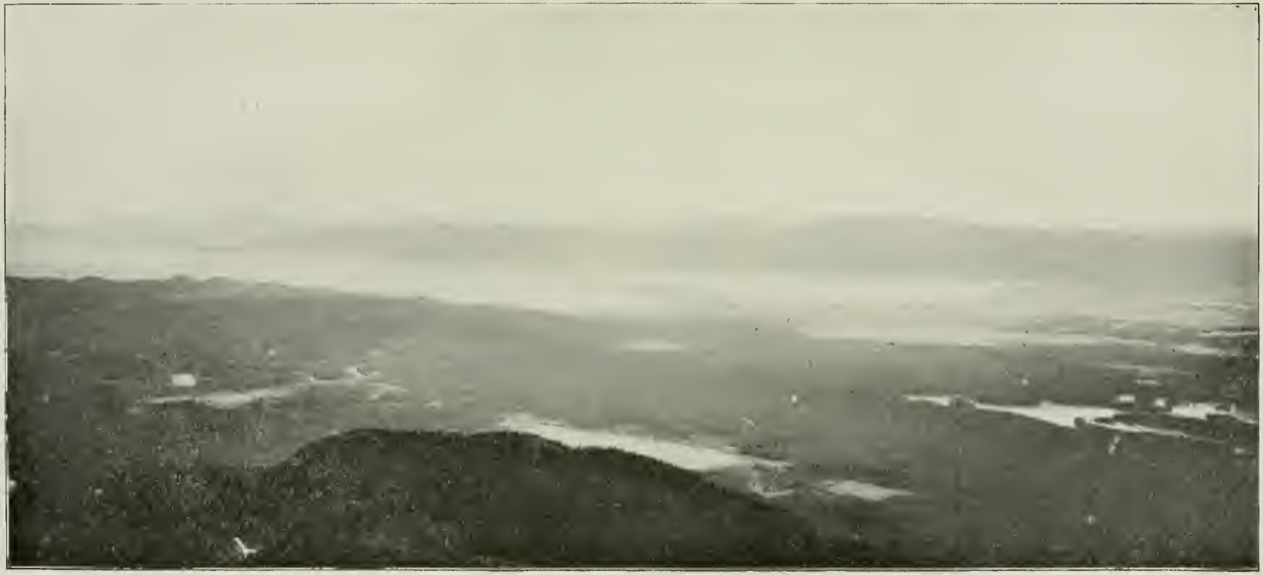
Making the ascent of McDonald Peak. Camp at 7800 feet in July. The spur on the left is from the main peak. See illustration with glacier, Plate XXXV. A glacier lies behind this spur. The shell, *P. strigosa*, var. *alpina*, was found on the shoulder above the camp, and up on a level with the snow. Note also the dead timber, killed by previous forest fires. Photo by Morton J. Elrod. The view is east.



The main Peak of McDonald, with glacier and snow field, from the saddle between the two peaks. A snow field lies behind the spurs to the right and left of the main peak. U. S. G. S. Triangulation Station on the summit. The view is south of east. Photo by M. J. E.

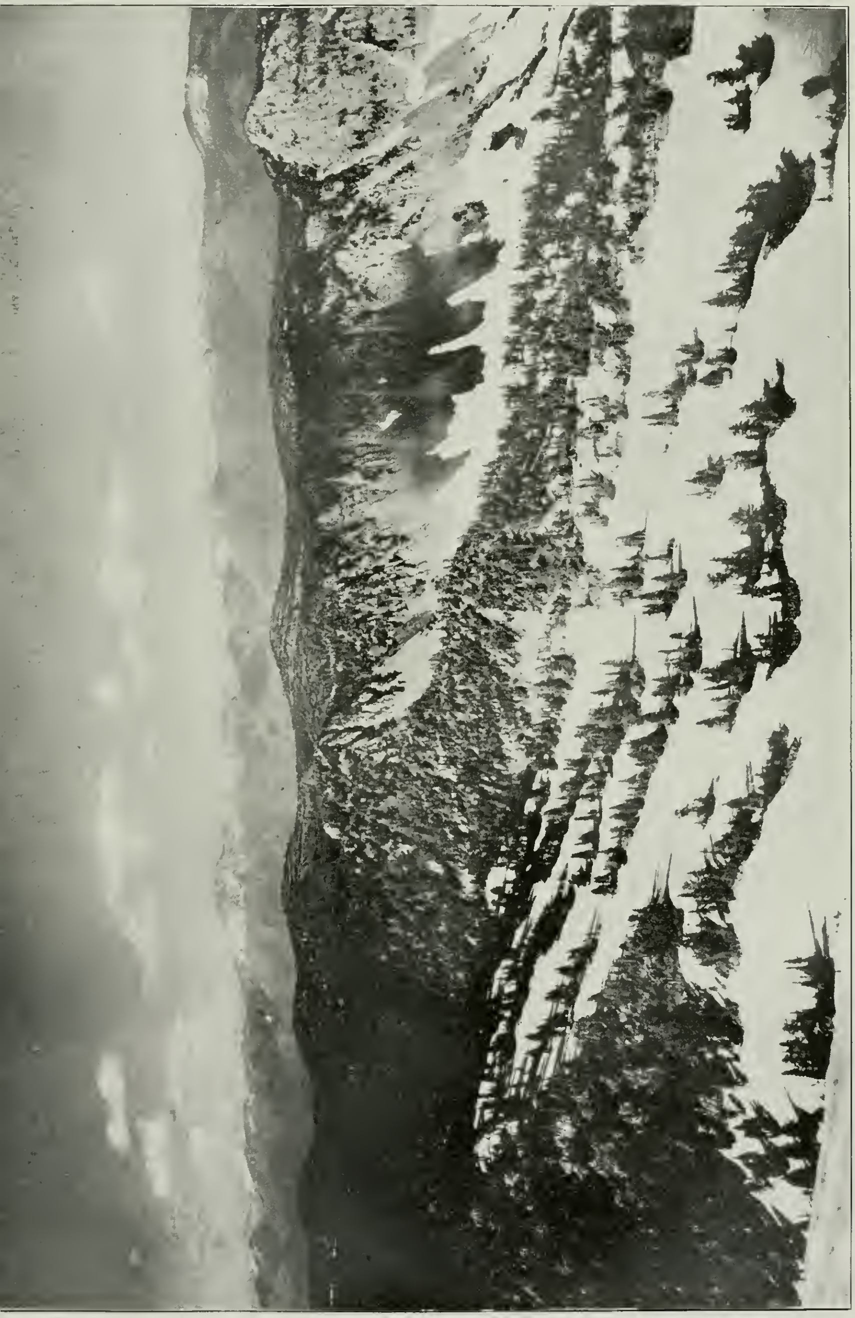

116°
115°
114°
113°
49°
48°
47°
BRITISH POSSESSIONS
Mountain Lake
Kintla Lake
FOREST RES.
BLACKFEET INDIAN RES.
ROCKY MOUNTAINS
KALISPELL
Biological Station
FLATHEAD LAKE
FOREST RESERVE
MISSION RANGE
FLATHEAD INDIAN RES.
LEWIS AND CLARK CTY
COLOMBIA RIV
Thompson
MISSOULA
DEER LODGE CO'TY
IDAHO
BITTER ROOT MOUNTAINS
STAT MILES
Trail
Road

Map of the northwestern portion of Montana, in which is located the University of Montana Biological Station.

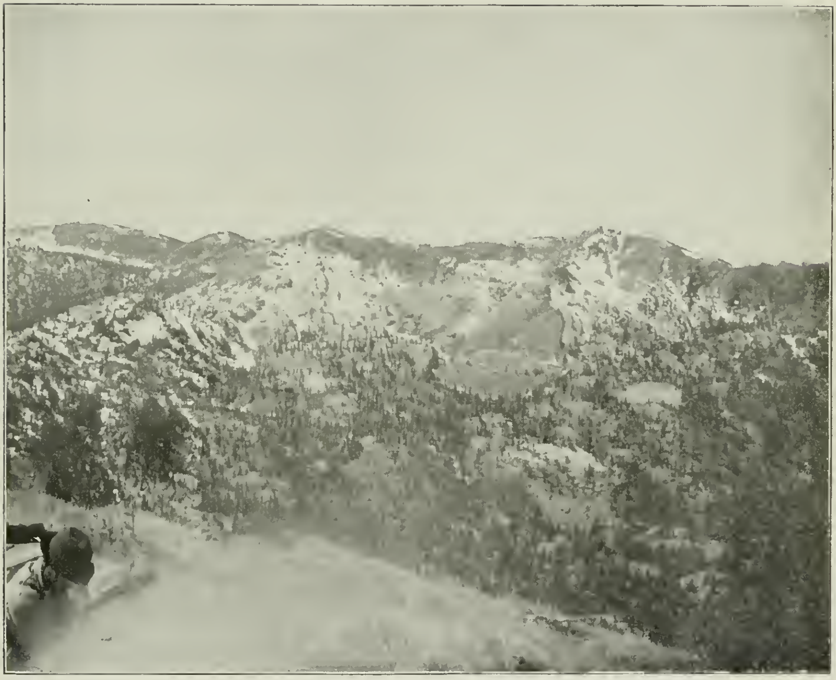


General view westward from the summit of MacDougal Peak. In the foreground is the wooded plain. Echo Lake is on the right, Rost Lake in the middle foreground, Swan River on the left. In the distance is Flathead Lake. The point of land extending into the lake is the delta of Flathead River. Photo by M. J. E.

Plate XXXVIII.



Dodge Mountain, from the Summit of MacDougal Peak. The view is south of east. Beyond Dodge Mountain is the valley of the South Fork of the Flathead River. In the distance is the main range of the Rockies. Photo by M. J. Elrod, in July, 1901.

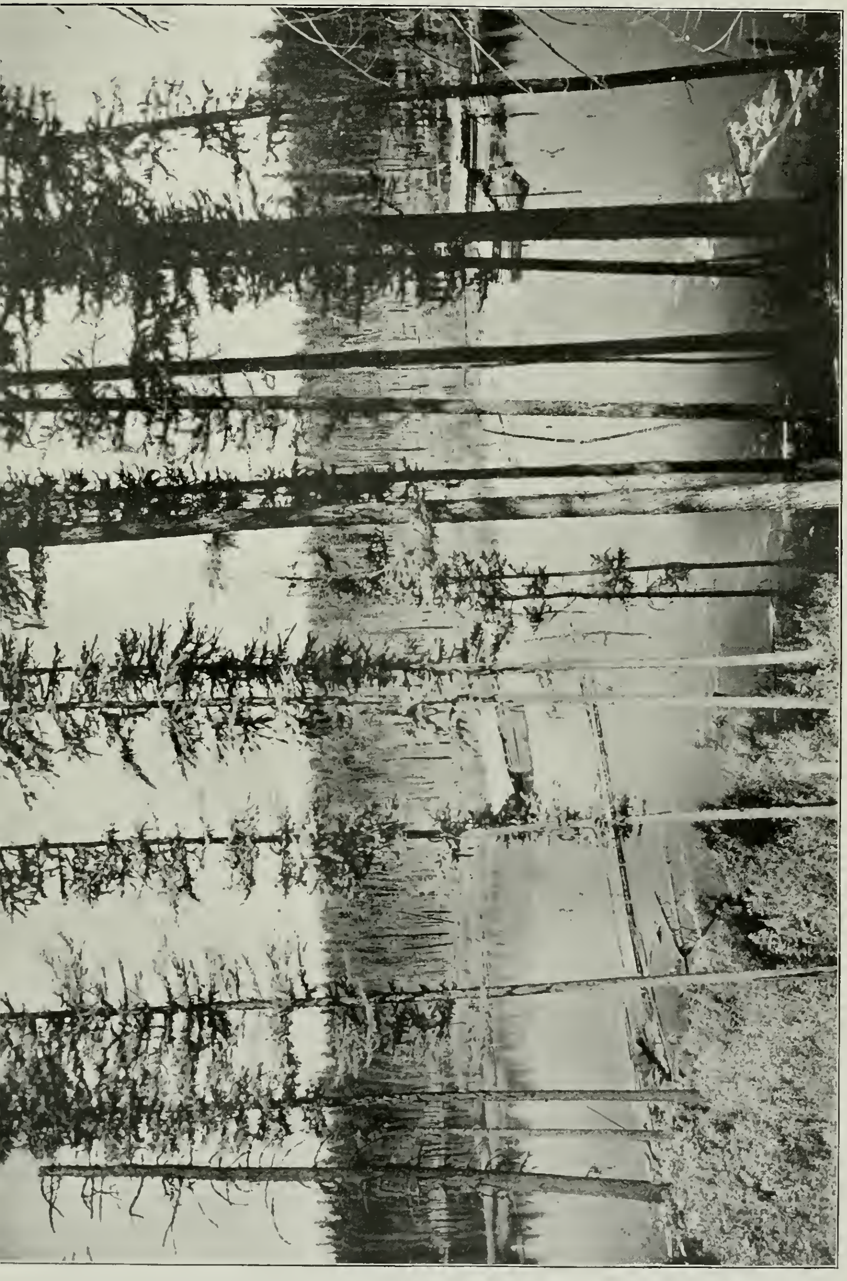


Craig Mountain, from Silloway Peak. View is from its eastern side, showing the long crest with several summits. Wolf Creek heads in the snow visible. On the left is a series of faults, swept clean and smooth by sliding snow. Photo by Maurice Ricker.

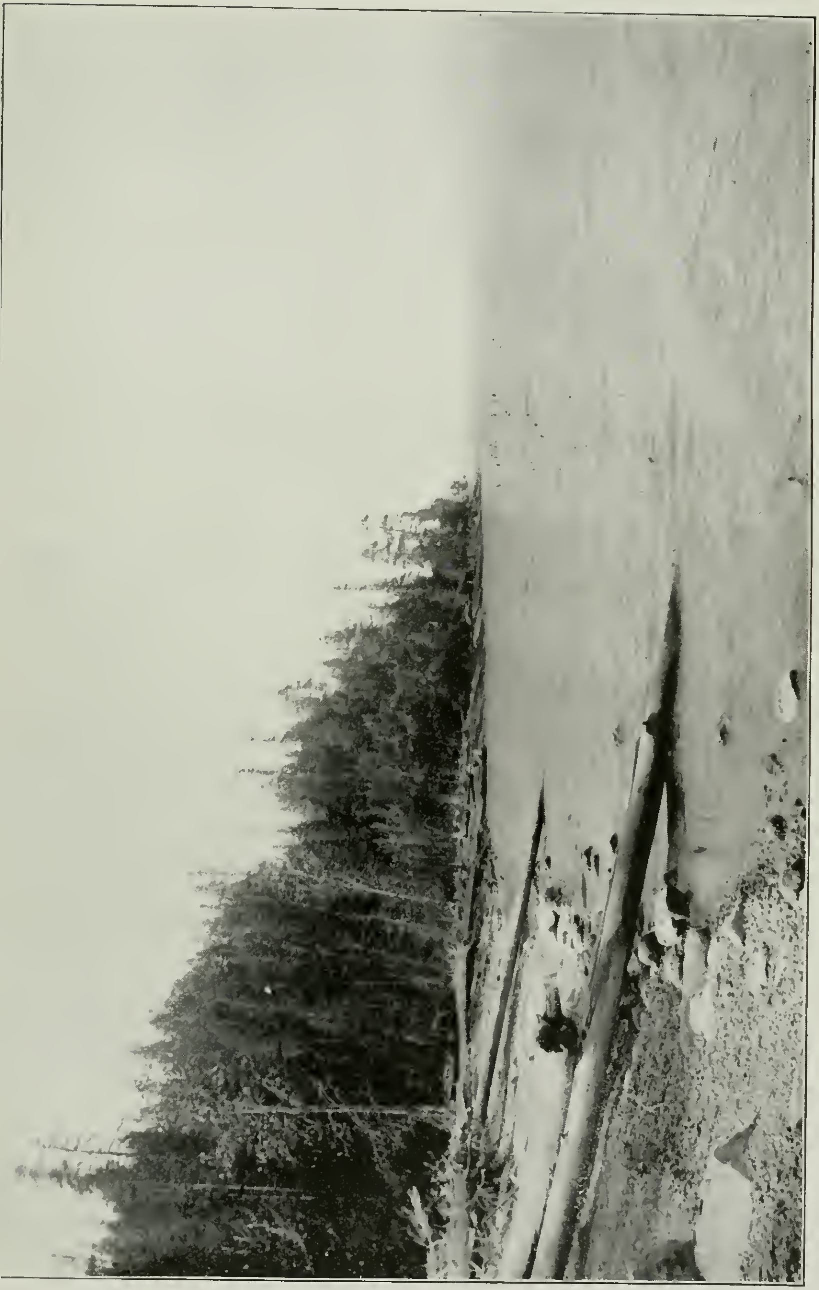
Collecting party with packs, on the summit of Silloway Peak, showing mode of carrying loads in mountain work. Craig Mountain in the background. The view is south. Photo by Maurice Ricker.

Showing sleeping bags as used in mountain work.

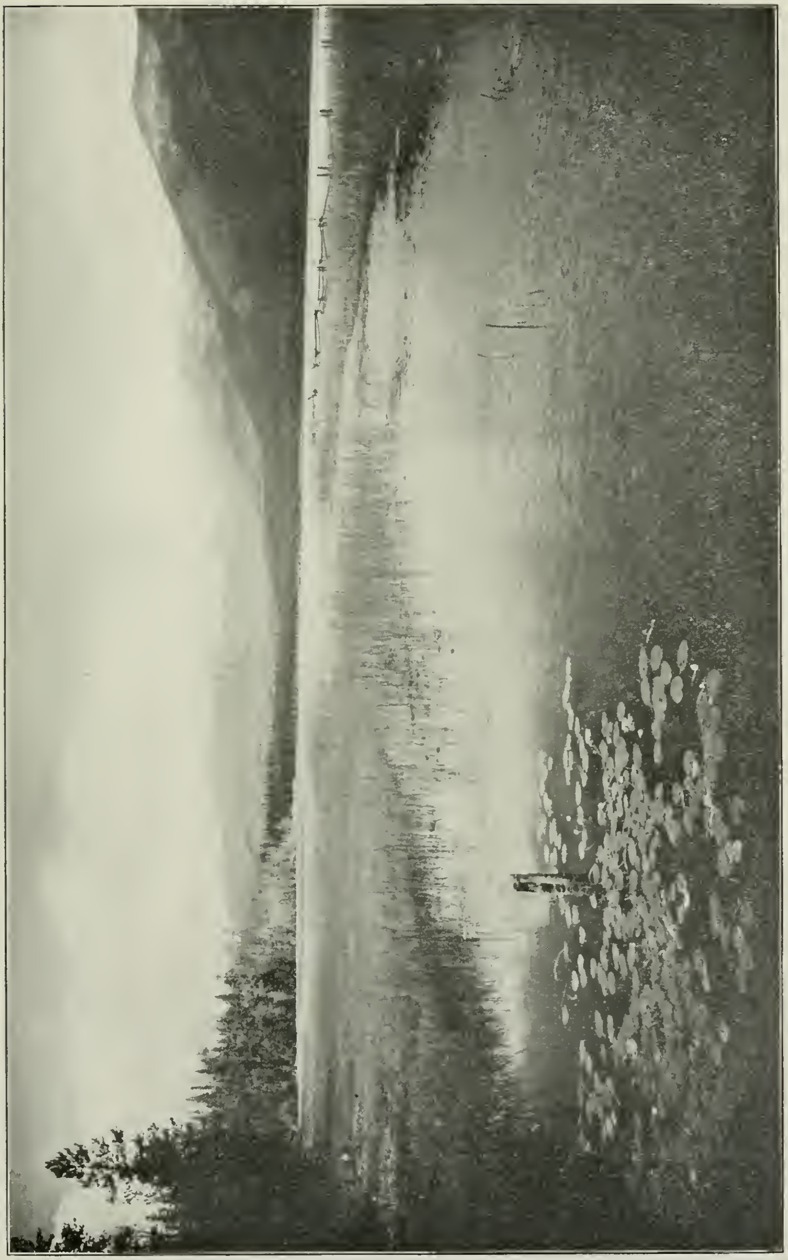
Plate XLII.



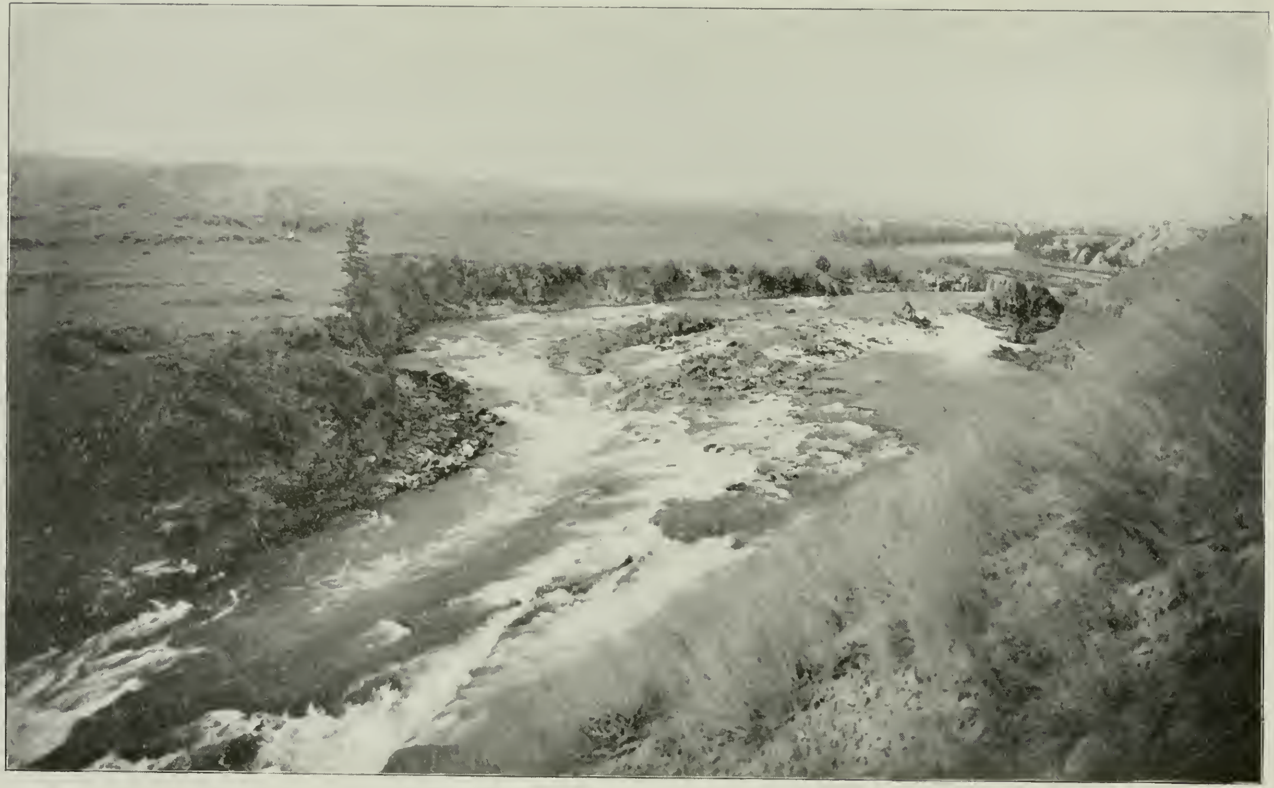
A portion of Echo Lake, showing submerged cabins and timber land. The bridge is the place at which the new hydra was found. The view is north. Photo by M. J. E. The portion shown is "new lake" made by the permanent elevation of lake level.



A portion of the beach of Flathead Lake near the Station, showing general character. The view is south. Photo by Mrs. J. M. Hamilton. By permission of the Am. Mic. Soc.



General view of Rost Lake from the outlet. The Swan Range of the Kootenais is in the distance. The view is east of north. Photo by M. J. E.



Rapids in the Pend d'Oreille River, showing the fall and rapid cutting of the river. This is about two miles from the lake. View is taken from the morainal bank. The large rock which it was intended to remove is plainly visible in the middle of the stream in the right of picture. The view is north. Photo by M. J. E.

View of Flathead Lake from the Moraine at the foot of the lake. The lake is about two miles distant from the point of view. In the distance is seen the islands which cut the lake in two. The main lake lies beyond these islands. To the left is the outlet, the Pend d'Oreille River. The view is north. Photo by M. J. E.

Bulletin University of Montana, No. 14.
Biological Series No. 4.

University of Montana Biological Station

AT

FLATHEAD LAKE.

Post Office, Bigfork, Montana.

FIFTH ANNUAL SESSION.

A COLLECTING PARTY ON FLATHEAD LAKE.

ANNOUNCEMENT

FOR THE

SUMMER OF 1903.

University of Montana, Missoula, Montana, 1903.

Entered August 24, 1901, at Missoula, Montana, as second class matter, under act of Congress July 16, 1894.

ANNOUNCEMENT.

The Lake Laboratory or Biological Station of the University of Montana is designed to provide opportunity for investigation of the biology of the lake and mountain region, and for giving courses of instruction in botany, zoology, entomology, nature study and photography. The work is adapted to students of the University and of high schools, teachers of the state, inexperienced beginners in natural history, and original investigators. The following statements give an outline of the plans for the summer of 1903.

STAFF OF INSTRUCTORS.

Oscar J. Craig, President of the University, Lecturer.

Morton J. Elrod, Prof. of Biology, Director of the Station, Botany and Entomology.

Maurice Ricker, Principal, Burlington (Iowa) High School, Zoology, Photography.

P. M. Silloway, Principal, Fergus County Free High School, Ornithology, Nature Study.

LOCATION.

The field laboratory is located on the bank of Swan River at its outlet into Flathead Lake. This location affords a fine harbor for boats and a good camping site for the tents of those attending. The adjacent region contains forests, ponds, lakes, swamps, cultivated fields, mountains, rivers and ravines. It is rich in animal and vegetable life. The lake offers rare opportunities for collecting, and presents some beautiful scenery. East of the lake the Mission range comes abruptly to the water's edge. The range slopes from the Swan river on the north to the high peaks, ten thousand feet, at the southern end, and its scenery is wild, rugged and grand, truly Alpine in character, and rivaling the Alps in beauty and magnificence. West of the lake are the Cabinets. Near the Station Swan lake, Rost lake, Echo lake, and other waters, are easily accessible. Daphnia pond, a few minutes walk from the Station, is rich in pond life, while Estey's pond, about as far again, is fully as productive. The Swan range is easily accessible from the Station, and Alpine summits are annually visited. The scenery is very fine, and Alpine collecting is remarkably good. The Station is not difficult of access. The stage and boat rides are easy, with charming scenery constantly in view.

EQUIPMENT.

The building is a convenient out door laboratory, with tables for a dozen students. The station work has entirely outgrown the building. Many of the lectures are given out of doors in the yard. The fine summer weather permits of much laboratory work out of doors. There is a dark room for photography. There are three boats which are the property of the Station. Other boats may be had at any time. Microscopes, glassware, books and utensils will be supplied from the University. Botanical collecting and drying material will be supplied.

Students in Ornithology must supply their own guns or field glasses. Necessary ammunition will be supplied at cost. Students in Photography will furnish their own cameras and plates. The necessary chemicals for development will be supplied free. Students who live in tents will supply their own tents and bedding.

COURSES OF STUDY.

Zoology:—

(a) Laboratory and field work, including dissection or microscopic study of type forms, with field work and instruction in collecting and preserving for laboratory use and permanent collections.

MacDougal Peak, Swan Range, visited annually by parties from the station. Photo by M. J. E., August, 1902. The view is south. Alt. 7725.

(b) Field and laboratory course in entomology. Instruction in collecting, preserving and labelling insects. Dissection and study of type specimens. A study of injurious insects.

(c) Ichthyology. Special course devoted particularly to the lake and river fishes and their food supply. The course will include plankton study.

(d) Ornithology. A study of birds, with methods of collecting, making and preserving skins; habits and lives of birds of the rich avian region adjacent.

Botany:—

(a) Laboratory and field course; study of type forms. The course will consist of collecting trips in the field where common species of the different orders are found, classification of the more common species, study of structure, with methods of preservation, both dry and in liquid, for immediate and permanent use.

(b) Ecology. General course including local ecological problems and local plant geography. For this the region offers a rich field.

Photography:—

No regular course will be given in this subject, but every aid which the station can give will be given those who wish to become proficient in this art. Students in photography must supply their own plates or films and paper. There is a dark room at the laboratory and the scenery in the vicinity gives ample scope for a series of negatives either in landscape or of scientific subjects.

Nature Study:—

A course of study and practical work will be outlined which will afford both a fund of information on which to draw during school work and at the same time secure a collection of material to be used in illustration. The scope of the work will include zoology, botany, geology, and physiography of the region.

INVESTIGATION, ADVANCED COURSES, UNIVERSITY CREDITS.

It will be noticed that several of the advanced courses cover ground of University courses. Students with University standing may secure credits for work which is equivalent to University courses. Students taking elementary courses may secure preparatory credits. Elementary courses are also adapted to high school pupils or nature study teachers. The opportunities for research are exceptionally good in some lines, and every facility will be afforded persons carrying on such work. Special work will be outlined for those fitted to carry on advanced study.

METHODS OF INSTRUCTION.

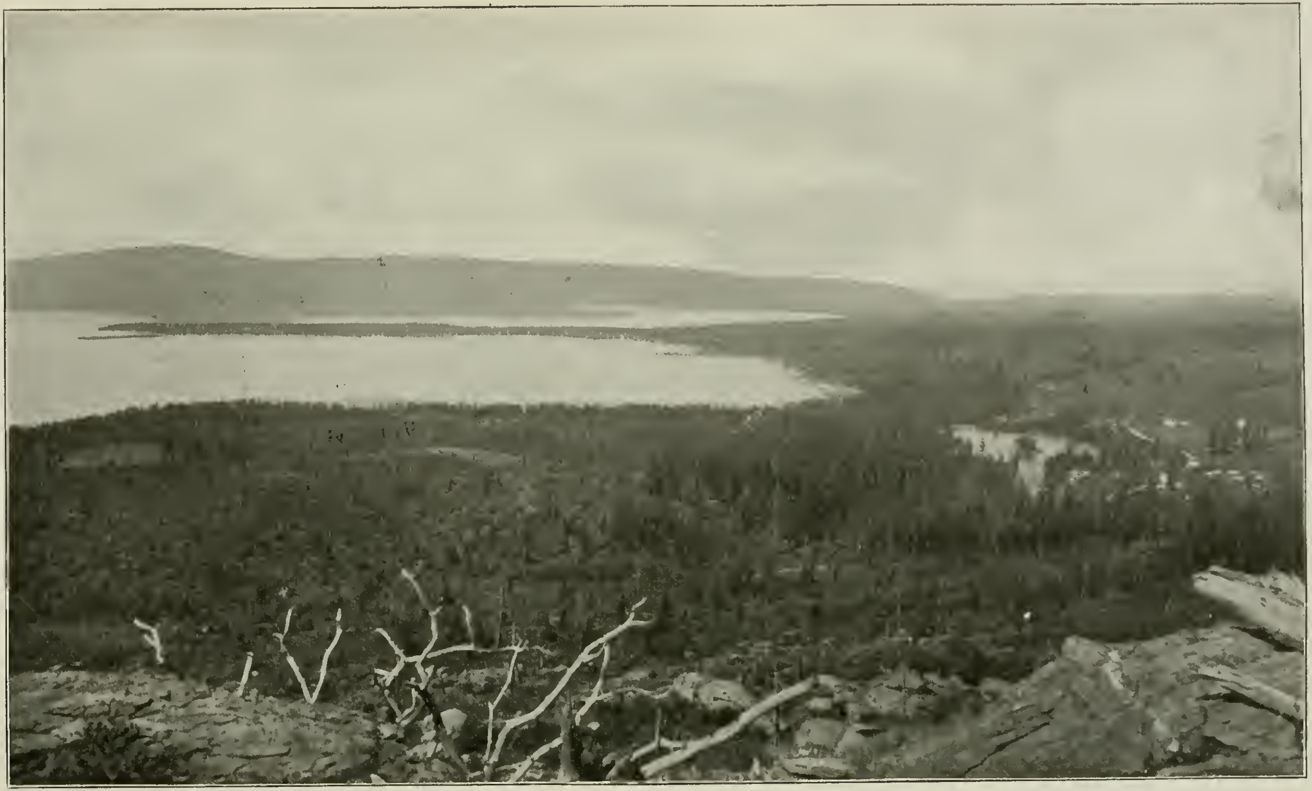
The work will consist very largely of field collecting and observation, study of relation to environment supplemented by laboratory dissections and microscopic examination. The general courses will enable teachers to familiarize themselves with methods of field work, and give a store of information from which to draw in nature study subjects. The general courses also give opportunity to students and others to pursue lines of study with better facilities for out door work with fresh material, than is generally to be had in regular university work.

The expeditions are primarily to give opportunity for the study of animals and plants in their natural environment. By this means more lasting interest is aroused, and more accurate information is obtained.

LECTURES.

Almost every day a lecture on some biological topic will be given at the laboratory. In 1902 sixteen lectures were presented. These have proven very valuable and helpful, and were well attended. The following are some of those to be given the session of 1903:

Adaptation in Animal Life; The Entomostraca of Flathead Lake; Wind Movements as Observed at Swan and Flathead Lakes; The Fishes of Western Montana; The Geology and Zoology of the Mission Range of Mountains; Aquatic Life in Air-breathing Animals; Recognition of Our



Upper end of Flathead Lake, with valley, from Prospect hill. Swan river enters the lake from the right. The station is on the river bank. The tongue of land is the delta of Flathead river. Photo by M. J. E., July, '02. The view is N. W.

Native Trees; Animal Counterfeits; Our Game Birds; Nature Study in the Grades; How to Know Birds; Adaptations in Bird Life; Bird Life of Daphnia Pond; The Use of Photography in Science; The Importance of Plankton Study. Others will be added to the list. Pres. Craig will be present for a portion of the time and will give several lectures.

EXCURSIONS.

The following excursions will be taken during the session of 1903, unless the weather is unfavorable:

1. A trip to Swan Lake, through the forests, with stop over night at the lake. This is a beautiful lake in the mountains, of great interest biologically and geologically.
2. A trip to Rost Lake, at the base of the Kootenay Mountains. This is a lake almost filled up, a fine collecting field. It is an admirable location for camps.
3. An ascent of MacDougal Peak via an Indian trail, to an altitude of 7,725 feet. This will afford opportunity for alpine collecting, and will present some of the most sublime scenery in the world.
4. A trip around Flathead Lake, making study of its banks, bays, and swamps.
5. A visit to the Ryther herd of elk, where may be seen many of these noble and fast vanishing animals.

These trips will be under the personal supervision of the Director of the Station. Those taking the trips must bear a proportionate share of the expense necessary. Such trips will prove of great value and interest biologically aside from the pleasures they bring.

HOW TO REACH THE STATION.

Students via Northern Pacific will get off at Selish. Stage tri-weekly runs to Flathead Lake (35 miles), connecting with steamer Klondyke, which runs across the lake. Stage fare, one way, $3.00, round trip, $5.00, trunks extra. Boat fare across the lake, one way, $3.00, round trip, $5.00. Stage leaves Selish on Mondays, Wednesdays and Fridays, connecting with the steamer, returning the same day.

Students via Great Northern will get off at Kalispell, connecting by stage with the steamer Klondike at Demersville, a short distance from Kalispell.

BOARD AND ROOM.

Most of those at the Station, including the staff, live in tents. A few tents are for rent. Day board may be had at Sliter's hotel for $5.00 per week. Board and room may be had at $7.00 per week. Many prefer to do their own cooking. The stores supply all the necessaries of life, while the region affords an abundance of fruit and vegetables. Daily mail gives easy communication with the outside world. There is also telephone connection.

RECREATION.

Many will wish to combine an outing with study. Fishing near the laboratory is excellent. There are many boats besides those of the Station, and rowing may be indulged in. The field is excellent for photography. Bathing in the lake is always a treat and the beach is fine. The region has an abundance of fruit of all kinds. The hills and forests afford quiet retreats for study or for strolls. Few places have more natural attractions. At the proper season hunting is good. Deer have been seen annually a few rods from the laboratory. Grouse and pheasants abound in the hills. In season duck shooting is fine. Most of the country affords good wheeling for bicycles.

DATE OF OPENING.

The laboratory work of the Station will begin Monday, July 13, and continue five weeks, or until Saturday, August 15. For a week or more before the Station opens some one on the staff will be at or near the

Station, and will aid any who may choose to work during such time. The laboratory is at the disposal of students from June 15 to September 1st, or even later, if any wish to use it.

AFTER THE SESSION.

At the close of the work at the laboratory the station staff will carry on investigations and make collections in the vicinity, Senator Wm. A. Clark having made a contribution for this purposee. It will be possible to accommodate a few additional persons in this work. The work is severe and is not possible for many. Those accompanying must pay share of the expense. Correspondence should be held early, so as to mature plans.

EXPENSES.

The Station is a department of the University of Montana. The policy of the State Board of Education is to make all work of the University free to residents of the State. In conformity with this plan there is no tuition or laboratory fee charged. Students attending will pay for breakage. It is thus possible for students to come from remote sections of the State, spend six or eight weeks in study under the most favorable conditions, with the best facilities the State affords, at a minimum expense. Correspondence is invited. There is no similar work offered in the Northwest. Considering the difference in fees and the facilities for camp life attendance may be made with as little expense as at eastern stations from the same distance, with work in a new field, and with side trips and short expeditions such as no other station offers.

HINTS FOR THOSE CONTEMPLATING ATTENDANCE.

Avoid bringing trunks. Large trunks are very difficult to handle, and transportation is expensive. Steamer trunks are less troublesome. If possible pack outfits in rolls, covered by canvas, fastened by large and strong straps. Hand baggage of any kind is not troublesome.

Outdoor and working clothing is adopted by all. Heavy shoes are a necessity. No other kind will stand the wear, if there is to be travelling.

Those who sleep in tents must remember the nights are always cool. A cheap tick, ready to be filled, and two comforts or heavy blankets over, with whatever is desired under the individual, are necessary. These can be purchased after arrival, if this is desired and at reasonable rate. In place of the preceding a sleeping bag is both a luxury and a necessity.

Reduce baggage to a minimum in weight. Heavy weight of books is not advisable, but reading matter for leisure moments should be brought.

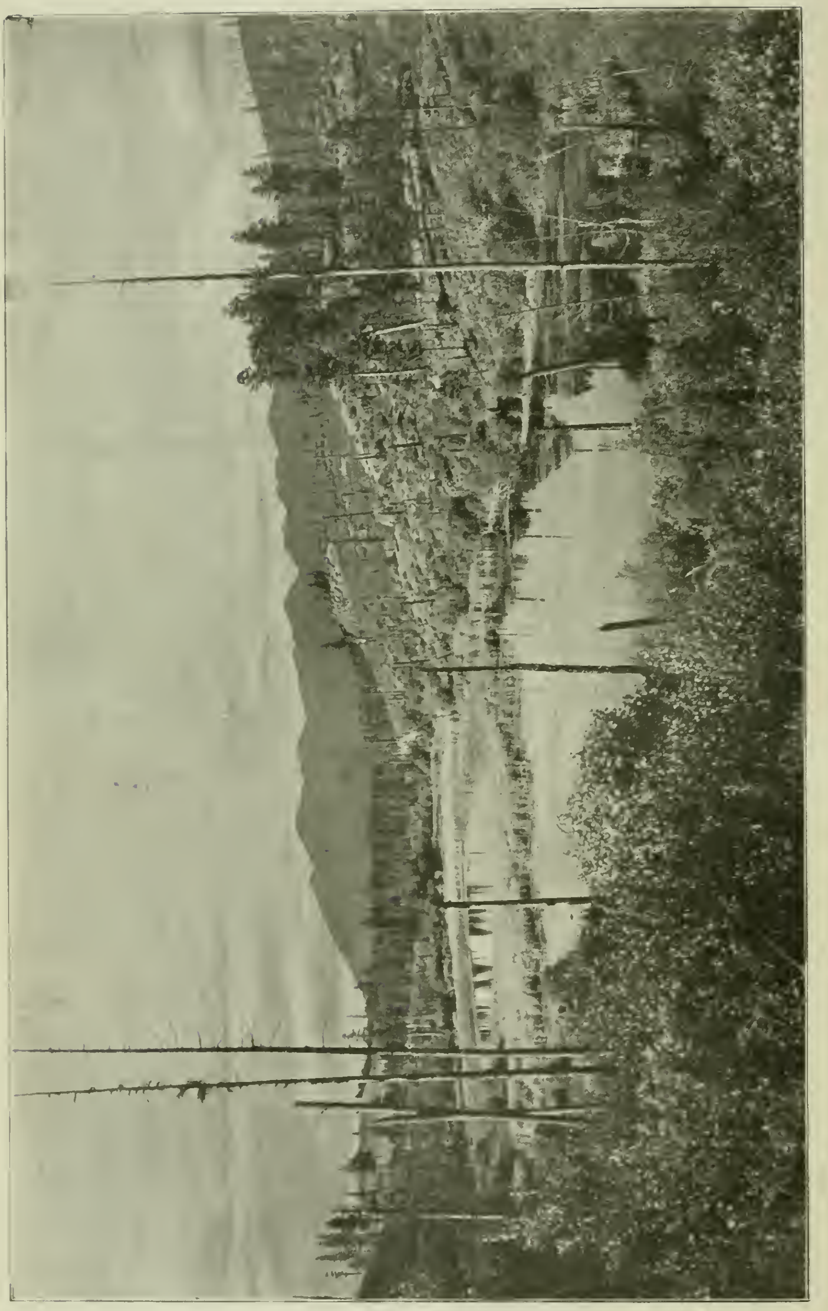
In matter of tents leave poles at home. There is abundance of lumber in the region.

For any further information address,

MORTON J. ELROD, Director,
Missoula, Montana.

For information concerning the University, its departments, courses of study, etc., address,

OSCAR J. CRAIG, President,
Missoula, Montana.



Daphnia Pond, near the station; a fine collecting field. Photo by M. J. E., August, 1902. The view is north.

BULLETIN UNIVERSITY OF MONTANA.
No. 17
BIOLOGICAL SERIES No. 5.

Lectures at Flathead Lake

A Series of Lectures delivered at the University of Montana Biological Station at Flathead Lake, by the Staff of Instructors, Session of 1902.

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UNDER DIRECTION OF MORTON JOHN ELROD.

University of Montana, Missoula, Montana, U. S. A.
1903.

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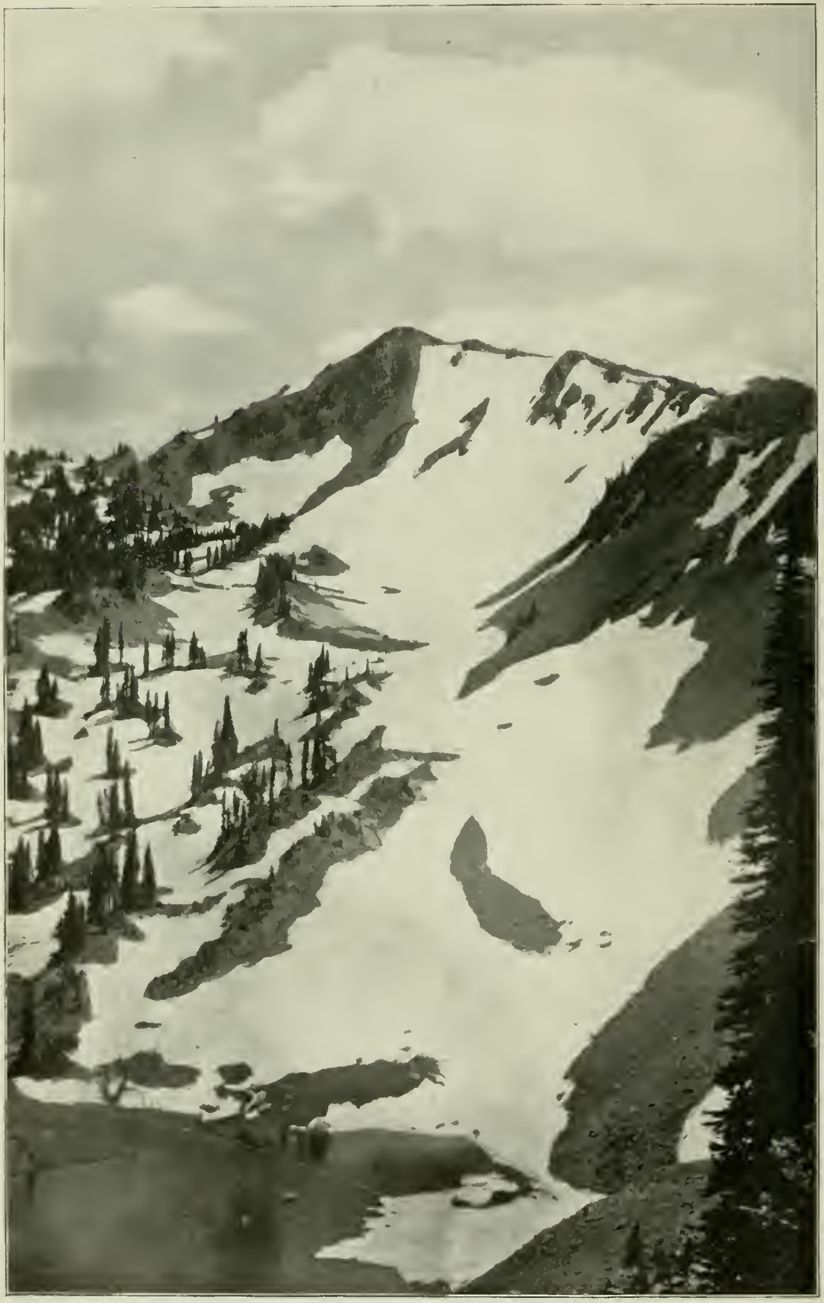

MacDougal Peak, Swan Range, from the ridge, showing snow field with ice. Note how the timber seeks the drier ridges. Photo by M. J. E., August, 1902. The view is south. Altitude of summit, 7725.

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University of Montana, Biological Station, Bigfork, Mont.,
Under Direction of Morton John Elrod.

University of Montana, Missoula, Montana, U. S. A.
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LECTURERS AT THE UNIVERSITY OF MONTANA BIOLOGICAL STATION, 1902.

Morton John Elrod, Professor of Biology, University of Montana; President, Montana Academy of Sciences, Arts and Letters; Director of the Station.

Harry Nichols Whitford, Assistant in Botany, University of Chicago, and Collaborator in Bureau of Forestry, United States Department of Agriculture.

Perley Milton Silloway, Principal Fergus County, Montana, Free High School, Author of "Some Common Birds."

Maurice Ricker, Principal Burlington, Iowa, High School, Member Iowa Academy of Science.

INTRODUCTION.

The material presented in this bulletin consists of a number of lectures or talks delivered at the University of Montana Biological Station in the summer of 1902, by the station staff. Not all the lectures are given. Many of the illustrations, such as photographs, charts, and drawings, have of necessity been omitted, owing to the expense of reproduction. The lectures on protective resemblance and mimicry were illustrated by numerous colored drawings and charts, the work of Mrs. Maurice Ricker. But few of these can be reproduced, and they only in black and white. While the absence of numerous illustrations is to be regretted, it is thought the material presented will be of sufficient aid to warrant publication.

The lectures are given for a double purpose.

1. They should be of great service to teachers of the state in nature-study work. Several are prepared expressly for this purpose. Some of those treating of particular features of the locality may by slight modification be made to apply to other localities. There has been an urgent demand for just such information as is here presented, and the publication of the lectures will answer many inquiries that have been received.

2. They will put before the people of the state some of the results of original work carried on at the station. This is all the more desirable since nearly all the observations in a new locality must for a time be new, and hence deeply interesting. It is hoped they will show in part the wide field open for research, and encourage the attendance of many who are seeking such a place for study.

Since the lectures or talks were delivered to audiences of whom many were unacquainted with the subject and with technical terms the simplest language has been used, thereby making them of greatest service.

M. J. E.

Missoula, Mont., April 27, 1903.

The Physiography of the Flathead Lake Region.

Morton John Elrod.

The first thing one must do in a new locality is to become familiar with 'the lay of the land.' The surface geography and geology of a region must first be understood if one is to seriously discuss the botanical or zoological life. The character of the soil determines to a large extent the general character of the vegetation, and the surface irregularities will indicate the nature of the zoological life. In a region where roads, fences, houses, and similar works of man are absent, a knowledge of the country is all the more important in order to get over the country. Since much of the country is as yet unexplored the physiography of the region will be especially interesting to those working at the station.

The views here given are based on the observations of the past four years. Later study may require that they be modified in part, but it is believed the observations will aid very much in working out the exact changes that have taken place in this section of the state. The glaciation of the region offers a good field for detailed work.

The Mission and Swan ranges of mountains, in northwestern Montana, lie parallel with each other, extending north and south in general direction. The Mission range is about seventy-five miles long, ending as a range at the Biological Station. The Swan range extends twenty-five or thirty miles farther north. Both ranges were made by faulting. The stronger throw was at the southern end of the ranges, where the high peaks, reaching 10,000 feet, are found. Between the two ranges the Swan river flows toward the north. It enters Swan lake, still between the ranges, far down the side. From Swan lake the river flows still northward for a few miles, then winds around with a big bend and turns westward through a new channel to its inlet into Flathead lake. That portion of the Swan range which extends north of the Mission range borders directly on the valley north of Flathead lake, rising abruptly from the plain, without foothills.

The formation of the ranges gave to the western side of each an abrupt and steep face, intersected with many ravines and canyons, with more gradual slopes on the eastern sides. The western base of the upper end of the Mission range is washed by Flathead lake, which for the greater portion of the distance meets the mountains with abruptness. There is little level or tillable land between, and often scarcely room for a wagon road.

South of Flathead lake a large valley, Mission valley, extends southward for thirty-five miles. North of the lake is another large valley which continues northward to the British boundary. On the western shore a spur range of the Kootenais shuts in the waters of the lake. The outlet of the lake is through a new channel, with a series of rapids, a foaming river of wondrous beauty, untouched by man's intervention, with only a trail along the bank and an occasional Indian path to the water's edge for fishing purposes. The lake is about thirty miles long. At its widest portion it is perhaps seventeen to nineteen miles. For the greater portion the width is no more than eight or ten miles.

Two rivers enter Flathead lake. Flathead river flows into the northern end near the center. Swan or Bigfork river flows into the northeast corner, past the site of the laboratory. See Fig. 4. Flathead is much the larger of the two, has a much larger drainage area, and carries into the lake much more sediment. The delta made by the river extends into the lake for more than a mile. Beyond this the lake drops off abruptly to deep water.

The preceding brief statements give the skeleton of the region to be covered in the work of the future, of which the present lecture is the smallest part. Let us consider briefly the agencies that have been at work in remodelling the surface, with the results as revealed by a rather superficial study.

When the mountain ranges were first upheaved their faces were abrupt and perpendicular. The valleys were deep and angular troughs between the ranges, rather than level valleys. It is believed that Flathead lake and the valleys to the north and south were formed by a slip in the faulting process, by which the western portion fell, leaving the mountain ranges as an abrupt border for a comparatively level plain. Evidence for this may be seen in the numerous photographs taken in the two ranges, which show plainly the stratification of the rocks, their slope and dip, and the configuration of the mountain range.

Immediately after this upheaval various agencies began the work of tearing down the ranges, and fashioning them and the valleys into their present forms. The agencies at work have been the wind and air, water, frost and ice, and the vegetation. Vegetation, as also animals, was absent at first, and came gradually, after the disintegration had been sufficient to afford a foothold.

The process of disintegration has continued from the first to the present, and continues now. It will continue until the entire mountain ranges are levelled. The rocks were alternately hot and cold, wet and dry. The small crevices were filled with snow and ice, which made them larger. Larger and larger they became, until pieces, large and small, tumbled from the face of the cliffs. Disintegration was slow or fast according to the nature of the rock. The smaller portions were washed down into the troughs between ranges, filling them up. While the larger channels between ranges were filling up the smaller gorges and ravines at right angles to these and between peaks were being ploughed deeper and smoother by the melting snows from above. The summits were being penetrated by the percolating waters, and the entire mass in some cases rent in pieces by the expanding ice. In some cases the faces of the cliffs fell away until the entire mountain tops fell, leaving the present summits a mass of boulders, still being slowly worn away by the wind and water. This is evidently the case with McDonald peak of the Mission range, as may be seen by the photographs taken at the western summit.

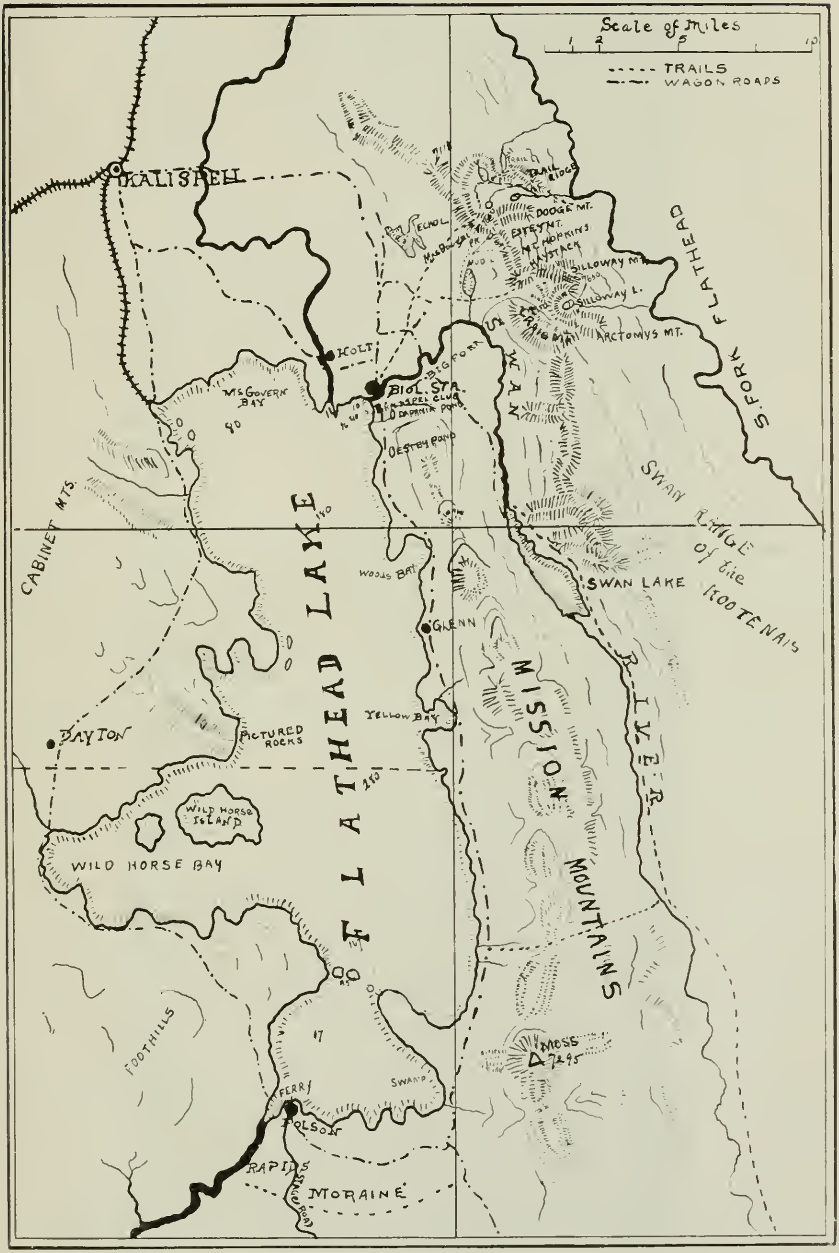
Scale of Miles
1
2
5
10
TRAILS
WAGON ROADS
KALISPELL
HOLT
BIOL. STA.
BIG FORK
KALISPELL CLUB
DAPHNIA POND
DESTBY POND
ECHO L.
McGOVERN BAY
RAIL RIDGE
DOOGE MT.
ESTEY MT.
MC HOPKINS
HAYSTACK
SILLOWAY MT.
SILLOWAY L.
CRAIG MT.
ARCTOMYS MT.
S. FORK FLATHEAD
SWAN RANGE of the KOOTENAIS
SWAN LAKE
SWAN R.
RIVER
CABINET MTS.
FLATHEAD LAKE
WOODS BAY
GLENN
YELLOW BAY
DAYTON
PICTURED ROCKS
WILD HORSE ISLAND
WILD HORSE BAY
MISSION MOUNTAINS
MOSE
7295
FOOTHILLS
FERRY
POLSON
SWAMP
RAPIDS
MORAINE
WAGON ROAD
40
140
250
17

Fig. 4. Map of Flathead Lake and adjacent region.

Lichens were probably the first forms of vegetable life to appear. These probably aided in the process of rock disintegration. As lichens apparently secure the greater part of their nourishment from symbiotic algae growing within their tissue they could and did thrive. Their decaying tissues formed the first vegetable loam which could support the higher forms of life. As other forms of vegetation appeared in succession the soil and rocks were held more firmly in place, making the tearing down process very much slower.

In later times came the ice age. The whole region was covered with a mantle of ice. How deep the river was is mere speculation. From the country adjacent to the laboratory which has been swept by it the depth was many hundreds of feet. At the lower end of Flathead lake a huge dam 450 feet high was left by the ice. At this time the lake was several hundred feet deeper than at present, and covered much of the northern valley, flooding the land on which the laboratory now stands.

How many advances and retreats of the ice mass covered the valley must be determined by more extended study, and by one more competent than I. Whether the main glacial mass was local or continental must be determined by others. From a careful study of the region I can give only the results as evidenced by glacial action.

During the glacial period large masses of ice no doubt slid down the steep mountain slopes into the wider ravines and valleys below, in the same manner as ice masses on mountain tops at the present time. These glaciers flowed into one large glacier whose movement was occasioned for the most part by the pressure from behind. The present valley of the Swan river was filled with ice whose movement was northward. At the same time a much larger ice mass was crossing the wide lake valley from the north. I am not able to say whether the ice mass slid over the frozen lake or whether it aided in gouging out a deeper bed. I am inclined to the former view.

This will be better understood from a study of the map of the region, Fig. 4. The first ice river had a direction represented by the present bed of Swan river. The second and larger ice mass had a direction across Flathead lake from north to south. At the low end of the Mission range these two forces met. The larger turned the smaller first at a right angle, then back on its course, but on the opposite side of the Mission range. On the ground in the immediate vicinity of this laboratory this meeting took place. It must have been a grand sight could it have been witnessed.

Also consult Fig. 5, which is a photograph from the summit of MacDougal peak in the Swan range. The Swan river ice flow came down from the left in the picture. The main flow was from the right. They met in the middle foreground. The lower summits immediately in front of the lake toward the observer were ground over by the ice mass.

On the summits southeast of the Biological Station, which may easily be visited, large boulders, weighing many tons, lie stranded. They are well marked with glacial grooves, and are silent witnesses of the great force which must have been used in their transportation. On some of the summits where the rock strata are undisturbed may be seen deep and

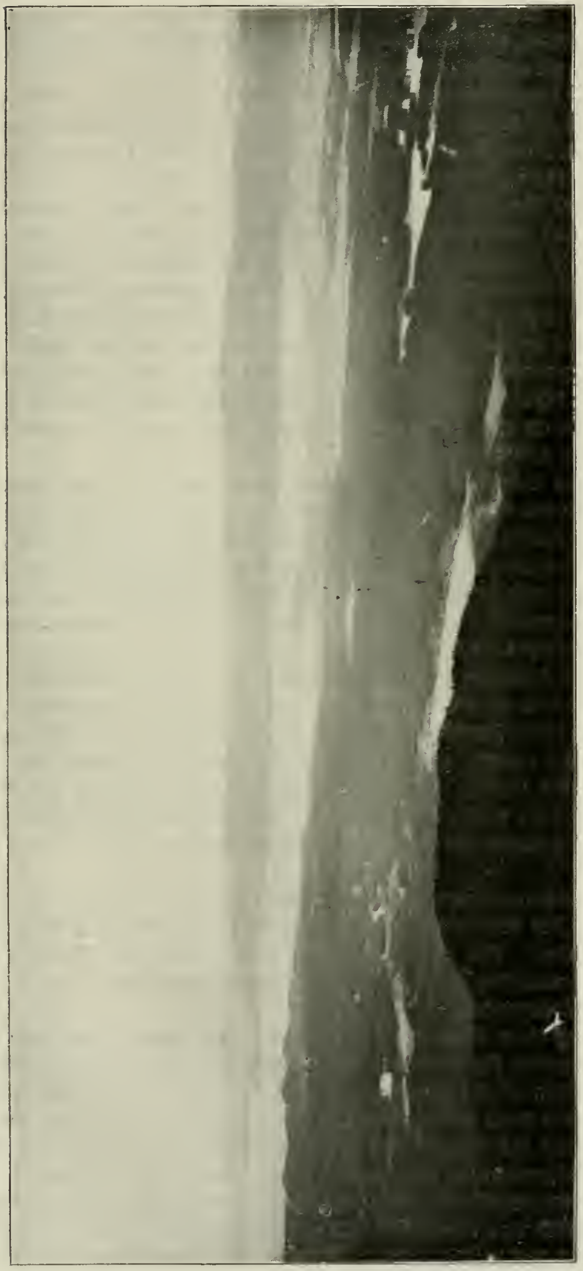

Fig. 5. General view westward from the summit of MacDougal Peak. In the foreground is the wooded plain. Echo Lake is on the right, Rost Lake in the middle foreground, Swan River on the left. In the distance is Flathead Lake. The point of land extending into the lake is the delta of Flathead River. Photo by M. J. E.

perfectly plain grooves in the rocks, showing plainly the direction of the ice movement. Also, on the east is the rounded surface made as the ice was forced upward, and on the west is the jagged cliff, unaffected by the ice as it broke off and tumbled over.

The larger ice mass extended across the Mission valley, pushed over the hills south of St. Ignatius Mission, where it left stranded boulders high on the summits, and on past Arlee to the Cabinet range. Whether it passed over or through these mountains I cannot say at this writing. The southern end of the Mission valley is marked by a high moraine. Its exact height has not been determined, but it is several hundred feet. This moraine is much broken, with many inequalities. From this region to the second moraine at the foot of Flathead lake is about thirty-five miles. This territory shows many evidences of glaciation, stranded boulders, hundreds of potholes, banks of pebbly nature, and the like.

As stated previously, the moraine at the foot of Flathead lake is 450 feet above the lake. It extends from the Mission mountains on the east to the Cabinets on the west. Its location may readily be seen by consulting the map again, Figure 4.

At the time this was made the outlet of the lake was through the arm at Wild Horse bay, and through the present Little Bitter Root river. An unusual amount of water caused the lake to rise unusually high, when it overflowed the moraine. The cutting was rapid, resulting in a lower lake level and a new outlet. The terraces at both ends of the lake show the successive levels of the lake at different times. There are at least three, and possibly four.*

The partial drainage of the lake laid bare a large stretch of country to the north, much of which was flat and swampy. It seems apparent that the Swan river flowed northward along the base of the Swan range, and close to the range, emptying into Flathead river near the present town of Columbia Falls. Evidence for this may be seen in the partially filled swamp lakes, while a distinct old bed may be traced through the timber for the greater distance, a veritable bog swamp for most of the season.

By some unknown means, most likely an unusual ice flow from MacDougal peak, 7,725 feet high, the river must have been dammed, causing a temporary lake. The overflow was across a low pass by short cut to Flathead lake, resulting in a new channel, the present bed, with its beautiful rapids and cascades.

In the earlier time Flathead river must have entered the lake immediately after leaving the mountains. When the lake was partially drained by the overflow of the moraine at the southern end the river meandered over the level mud plain until it found the lake. It cut a very tortuous channel for the greater distance, and has changed many times. In a distance of fifteen miles the river course covers thirty miles.

By the recession of the main ice sheet northward a large amount of morainal material was deposited in the valley, showing most plainly in a line north of the end of the Mission range. This line of morainal material

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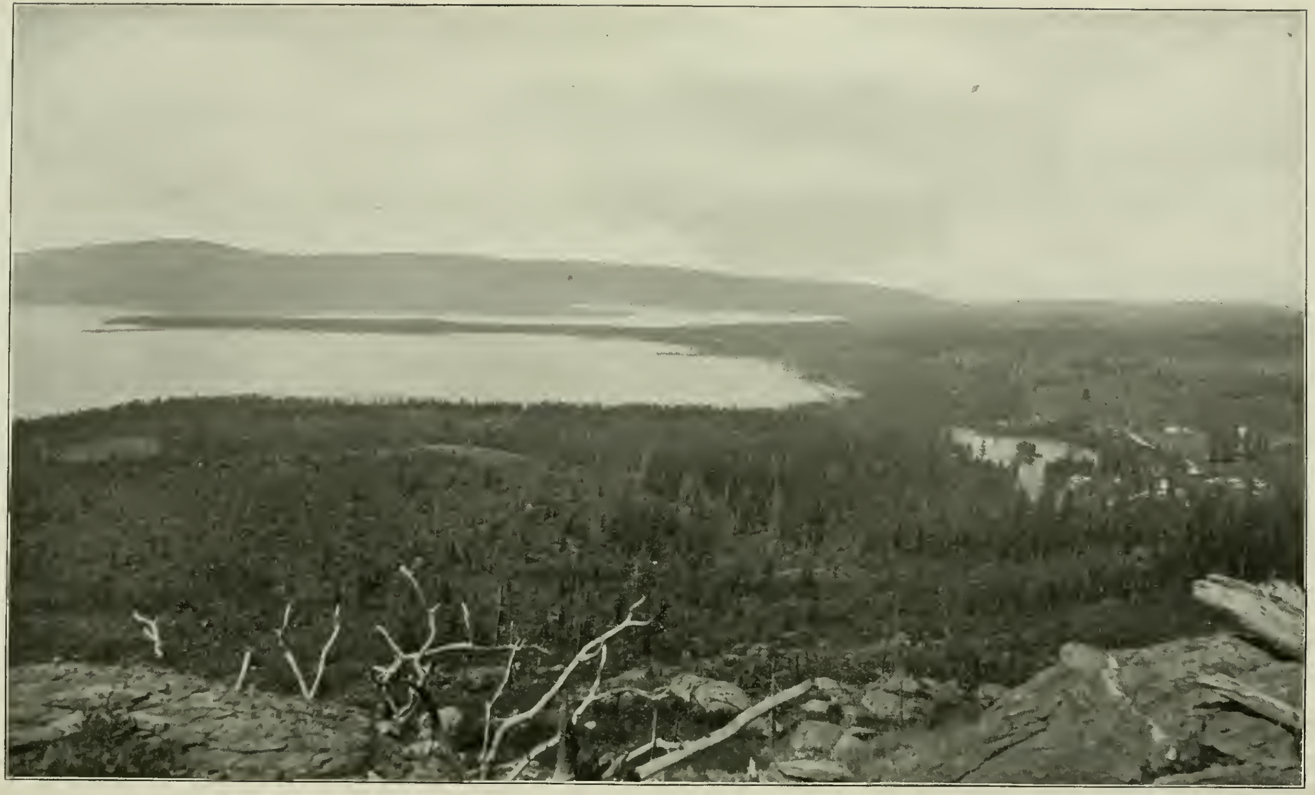
* This view is confirmed by Eliot Blackwelder, from the University of Chcago, who visited the region in 1902.



Upper end of Flathead lake, and valley, from Prospect hill. The tongue of land is the delta of Flathead river. Swan river is on the right, entrance to lake hidden by the forest. The laboratory is on the right bank of the river, the tents showing. The view is almost west. Photo. by M. J. E.

caused the waters of Swan river to be hemmed in between the Swan range and this glacial matter. When the river made its new channel to the westward the old channel was abandoned and soon filled up, owing to the fact that it had little fall, and was probably surrounded by dense forests such as now cover the region. A number of deeper places still hold water, forming some of the lakes in that region. The nearest of these to Swan river is Rost lake, which is less than two miles from the river. Next is Echo lake, north and west. It is quite certain that Echo lake was not a portion of the old river bed, but was formed by glacial action. Still farther north is Blaine lake, not yet visited, but lying in the old river valley.

Rost lake is nine miles distant from the laboratory northeast. It is about a mile long and less than ten feet deep in the deepest portion. In most places the water is less than three feet deep. It is bordered by dense forests, and is a dead lake, which in a short time will be a peat bog similar to many other swamps in the region.

Echo lake lies north and a little east of the laboratory. It is a land locked lake, with no surface outlet. Notwithstanding this it has several species of fish. Its outlet is underground through glacial drift, coming to the surface through large springs whose waters flow into Flathead river. The surface of Echo lake is quite unstable, and is likely to rise or fall any season. The lake has had very little study.

Swan lake has previously been mentioned. It is reached by wagon roads from the laboratory, the shortest being about eight miles long, the other about fourteen. Swan lake for the greater portion of its length is but an expansion of the river, hemmed in between the Swan and Mission ranges. Its location may be understood by an examination of the map, Fig. 4. This map is incorrect in part, as the upper end of the lake widens into a circular bay some two miles broad, bordered on the south by a large swamp. This swamp is covered densely with vegetation, and gradually gives way to grassy meadows, which in turn are bordered by dense forests.

The delta of Flathead river (Plate XLVIII) is worthy of extensive study, and is a good illustration of the method of filling up by sediment from a river. Very little sediment has been deposited by Swan river as compared with the Flathead. This is to be expected, since the former carries much less water than the latter. But the difference is very marked.

West of Flathead lake nothing has been done, and consequently little can be said concerning its physiography. This hasty and superficial view of the region will give those at the station an idea of the country in general, and will suggest more detailed study in many lines. There is still much to be done. The higher slopes of the Mission and Swan ranges have had very limited study. There are many lakes not yet visited. Much is left for the work of the future.

How to Study a Bird.

NATURE-STUDY LESSON.

Perley Milton Silloway.

The prime object of nature-study is the training of the powers of observation in such a manner that they shall minister to the higher intellectual faculties. It is not an end, but a means, whereby the observer obtains a stronger grasp upon the larger relations of life. Nature-study does not consider the probable destiny of the pupil as a botanist or a zoologist, but as a student of life in any or all of its relations, assuming that all Nature is simply environment which is to react upon the mind and develop its noblest faculties. Life is everywhere about us, and nature-study aims to teach anyone to see, hear, and appreciate that life, whether manifested in animal or plant. Hence the essential method of studying a bird is to cause anyone to see, hear, and appreciate the bird, and to consider its relationships as a part of the vast domain of Nature.

The primary step in the study of a bird is identification. The bird must be recognized, and to make recognition successful the object must be seen under circumstances which admit of definite observation. If the bird is a new one, a rapid inventory of the essential features of its description must be taken, and a fair idea gained of its size, form, color, and markings. The idea of size may be comparative, as somewhat larger than a chipping sparrow and smaller than a robin, or about as large as a pigeon. Attention must be given to the bird's form, or the general outline of the body. It may have elongated neck and short legs, like the geese; it may have both long neck and long legs, like the herons and cranes; it may be rather stoutly built, like most of the sparrows; or it may have a comparatively large head, like the flycatchers.

The prevailing colors must be noted, as general color of the upper parts, lower parts, head, wings, and tail. Then any striking markings should be carefully observed, as these markings are generally the quickest and surest means of identification. For instance, suppose we see a bird of black plumage, somewhat smaller than the robin, rather stoutly built, with prominent white bar on the wing. Upon reference to our book of descriptions, we learn that our new acquaintance is the lark bunting. Suppose we meet a blackbird, somewhat larger than our common friend of the feed-lot, with prominent yellow and white markings; we easily learn that our new friend is the yellow-headed blackbird. All these features in the foregoing descriptions should be promptly jotted down in a note-book, to be used when a key can be consulted.

The actions of the bird at the time of observation are especially important, for they often serve as a key to the family or group to which the bird under observation belongs. There are peculiar characteristics of certain groups of birds, as the flirting of the tail by the smaller flycatchers, the deliberate folding of the wings by the plovers upon alighting, the teetering of the body by the smaller sandpipers when standing or walking, and similar actions which will occur to your own mind.

The special appearance of any bird is a great help in recognizing or identifying it. It may assume some characteristic attitude that will have a likeness to pictures we have seen or may see, and thus we are aided in determining the name of the bird. Suppose we are collecting on the shore of Daphnia pond. Among the rushes we see (though it will take sharp eyes to see it) a slender, brownish bird of rather large size, with elongated neck and head pointed upward in meditative attitude. We remember that we have read of the bitterns assuming this posture, and we form an idea which readily aids in identification,.

In connection with the description and appearance of the bird we are studying, we should learn to note its movements that seem to characterize the species. The kingbird and other flycatchers will be seen to leave their perch, fly outward and upward irregularly, try to capture a passing insect, turn in air, and quickly alight upon the same or another convenient perch. The sparrow hawk will often hover in air, maintain its place by continued fluttering of the wings, and then swoop down upon its prey, or else continue its quartering flight. We notice a bird somewhat larger than the robin, with enlarged head and noticeable crest. It flies over the water with harsh rattling cry, hovers in mid-air to select a victim in the water below, and then dives head foremost. By these actions we have little difficulty in recognizing the familiar kingfisher. A small bird, not so large as the chipping sparrow, alights upon the trunk of a tree near us, and begins to ascend the bole by a zig-zag course, inspecting the crevices of the bark for lurking insect larvae. These movements aid us in identifying the little brown creeper.

Besides what we have mentioned of movements of the bird as one of a species, it is especially interesting to note what may be called the individual actions of the bird. This constitutes a higher phase of bird study than that mentioned in the preceding paragraph, but it is productive of greater results. It separates the bird in question from its group, and regards it as an individual, manifesting traits for which it alone is responsible. No other bird of the same species may go through exactly the same performance, nor exhibit its impulses of love or hate, courage or fear, anger or pleasure, in just the same manner. It is this phase of bird study that marks such naturalists as Ernest Seton Thompson, John Burroughs, Bradford Torrey, Florence Merriam Bailey, and a few others.

Early in the study of a bird the observer must become familiar with its song, call-notes, or cries. Color is generally difficult to distinguish at any distance from which ordinary observation is made, hence the voice of the bird is the means most useful to the observer in recognizing his feathered friends. In the mating and early nesting season, the songs of the birds are especially attractive, and at that time the music should be so associated with identification that thereafter the song will suggest the author. However, the song season is comparatively short, ending in early July at its longest, with the exceptions of the song sparrow, the meadow lark, winter wren, the vireos, and a few others. Hence the calls and cries of the birds should be learned if one's observations are to be extended throughout the year. Indeed, in late July and during August, few birds are seen, as then they are strangely silent and it is only by their few calls that their presence can be detected. Many birds which haunt the bush allow only an occasional glimpse of them as they flit through their leafy retreats; such birds must be recognized chiefly by their calls. Others, like the rails, skulk among the reeds of the swamp, and the observer must know their voices if he attempts to note their presence.

The manner of flight soon becomes a matter of importance in our study of the bird. The skimming, darting, ceaseless flight of the swallows is vastly different from the whirring wing-movements of the grouse. The low, undulating flight of the sparrows is altogether a different movement from the flitting, capricious, restless evolutions of the terns and gulls. The hawks and eagles flap and soar overhead in ever-widening circles which carry them cloud-ward; the longspurs mount upward in irregular, progressive gradations, and then descend with outspread, unmoving wings, parachute-like, singing as they descend. Our friend robin speeds through the air from point to point in a straight-away course, while the catbird flits from bush to bush with labored action and flipping tail. The flight is so characteristic that it becomes an important aid to bird recognition.

If one is to know much about a bird, he should know where to look for it. To study the bittern one must go to the reedy bog. For the sandpipers we must look along the sandy shore of lake, river, or pond. The song sparrow chooses the bushes bordering the water, while the vesper sparrow resorts to meadows rank with grass. The redstart hides the beauty of its black and orange-red plumage in the depths of the swamp-woods; the meadowlark scatters its ringing melody over the open fields and meadows. Audubon's warbler revels in the depths of the high coniferous woods; the vireos chant in the lower story of the deciduous trees. The American dipper loves the vicinity of splashing falls and foaming rapids of the mountain streams; the handsome lazuli bunting prefers the edges of clearings or the telephone wires of the roadsides. Thus we see that each species has its characteristic haunts, and a knowledge of these haunts is an essential part of our study of the bird.

The migrations of a bird, the time of its arrival in a neighborhood if it is not a resident, and its departure, form a leading part of one's knowledge of the birds of any locality. Many birds can be studied only while they are loitering in a neighborhood a few days in spring or fall as they journey northward or southward in their seasonal movements. The date on which any species is seen, whether an old friend or a new acquaintance, is worthy of permanent record. When to look for a bird is as valuable knowledge as where to look for it, or how it looks. The notes regarding the time of occurrence of any bird in one's neighborhood will form a series of observations which in time may be collated into definite information of the bird's local and seasonal movements.

The study of a bird really becomes an investigation of its relationships of environment. The most important of these relationships, from an economic point of view, is the food of any species, a phase of study which opens an almost limitless field for investigation. What a bird eats is information of practical value to the rancher and horticulturist,—not what a bird eats at some particular season, but what constitutes its bill of fare for the entire period of its sojourn in the locality. Many of the birds are invaluable assistants of the agriculturist. Frank M. Chapman mentions a cuckoo whose stomach at six o'clock in the morning contained the remnants of forty-three tent caterpillars. It was found that four chickadees had eaten 1,028 eggs of the cankerworm, and four others had eaten 600 eggs and 105 female moths of the same noxious insect.

Many ranchers regard the hawks as their enemies, because they are reputed to catch up an occasional young chicken. With the exceptions of Cooper's hawk, the sharp-shinned hawk, and the goshawk, in this region, this belief is quite erroneous. It has been ascertained that 90 per cent of the food of the so-called "chicken hawks" consists of injurious rodents and vermin. A single owl in two hundred meals was known to eat 450 destructive mice and similar vermin. The great horned owl is perhaps the only exception among the nocturnal rapacious birds. Instead of killing the hawks and owls indiscriminately, it would be wiser for the rancher to raise a few additional chickens for the use of his feathered allies. The horticulturist can easily afford to plant a few extra trees to supply the fruit-eating propensities of some of the birds, which live chiefly on insect food during the remainder of the year. When any known bird is seen to capture an insect under circumstances such that the prey can be recognized, or when the bird is observed eating vegetable food, a note should be made of the fact, and as continued observations are made a fair estimate may be computed of the economic value of the species.

The manner of the bird's taking its food furnishes an interesting subject of study. The flycatchers capture their prey a-wing, flying outward from some post of observation, snapping down upon a flying insect, and returning to their perch. The chickadee gleans from the crevices of the bark along the branches, finding insects and larvae that other birds have overlooked. The robin uncovers the worms lurking near the surface of the soil, or finds the destructive larvae burrowing in the roots of the grass-tufts, or else boldly visits the garden and helps himself to the ripening fruit. The osprey wheels above the lake or river, hovers in air when he spies a likely victim below, dives flatwise into the water, and emerges with his finny prey. The swallows flit in rapid evolutions, seemingly on tireless wing, in quest of flying insects, and seldom taking their prey in any other manner. The manner of feeding is quite characteristic, hence it serves as an important aid in identification, besides offering the student a subject for many valuable notes.

The bird's relation to man, in the matter of companionship or association, suggests itself as worthy of consideration. The robin is known to nest in the door-yard; the raven seeks some inaccessible cliff to rear its brood, and at other seasons it invariably shuns the presence of man. There is a noticeable difference in the dispositions of the representatives of different species, and even of different individuals of the same species in different localities, to confide in the associations of civilization. The bird student will note these differences of disposition whenever they occur to him, and make them a part of his information regarding any bird of his neighborhood.

Furthermore, the disposition of any bird regarding its companions soon becomes very manifest to the observer. He will not see the kingbird many times before its pugnacious spirit exhibits itself in sundry encounters with other residents of its domain or with unwelcome visitors to its neighborhood. No other bird ventures near the home of the humming-bird without quickly arousing the anger of the tiny owner, and the intruder is speedily reminded that he is a trespasser. Quite in contrast to these, the good-natured osprey allows the blackbirds and swallows to nest in the cavities of its bulky habitation. Some interesting scenes of bird-life are brought to the notice of the observer who looks for these incidents of the bird's associations with its neighbors. They are the real key to the inner life of the neighborhood in avian circles, and a part of that higher phase of bird-study of which we have already spoken.

In considering the relationship of the bird with others of its own species, we find that the mating affords a series of profitable and sometimes amusing incidents. More individual character is manifested at this period than at any other, and for obvious reasons the bird disregards much of its ordinary dislike of observation, frequently placing itself in situations where its actions can be easily watched. Most of the traits usually denominated as human are then displayed, jealousy and gallantry characterizing the males, while constancy and modest coyness are noticeable in the conduct of the fairer sex.

The courting and mating among some of the grouse is an instance of the amusing scenes at this season in birdland. The males congregate at a convenient place in the neighborhood, go through a series of struttings, with inflated necks and drooping, quivering wings, apparently displaying all the accomplishments of form and movement at their command, after which the most successful competitor takes the lady of his choice and the couple begin housekeeping at once.

Careful attention to the singing of any bird will disclose the fact that any performer has a variety of musical numbers in his repertoire. Our mountain song sparrow has at least half a dozen separate songs at his command, and I have known the same male to sing as many as eight different arrangements of his notes. The western meadowlark has from six to eight different songs, and with all the variations of the different songsters of this species, it is likely that twenty to thirty varying meadowlark songs could be formulated. The same song will be uttered several times, then a variation will follow for several renditions, and thus change after change may be noted. In the singing there is manifested the same individuality as in other phases of the bird's activities, so that it is possible for the attentive bird-student to identify particular birds in the neighborhood by the execution of their songs.

The nest-building of the bird, its home-keeping, and other domestic affairs, constitute the most interesting period of its annual round to young observers. Volumes have been written about the nesting time, as at that season the study of the bird presents its most fascinating side. Children are usually so interested in the nests, eggs, and young that the safety of the nest is imperiled. The teacher should make a collection of old nests in the fall, or lead the children to bring them in, studying the sites and surroundings, and thus sustaining an interest aroused when the birds were using their habitations in the earlier season. The history of the young in the nest has come to be a vital part of the study of the bird. If properly directed, children will be deeply fascinated in oberving the events which mark the rearing of a brood of young birds in their nest.

The study of a bird implies that the bird itself should be the subject of study, primarily a-field. The interest of the pupil may be stimulated until many common birds, at first unknown, will be observed, identified by the teacher's aid and by colored plates or descriptions, studied as a part of the neighborhood's wealth of wild-life, and thus a zeal for bird study aroused that will cause the observer to become a life-long friend of the birds. A bird may be observed by one of the pupils, or may be familiar to only one, but the knowledge of this one may serve as the teacher's means to introduce the bird to the entire school. Little by little the acquaintance is extended, until all become friends of the bird. Meanwhile others are brought to notice, and in a comparatively short time the majority of the pupils have established friendly relations with all the common birds of the locality. If any accessible literature concerning bird-life has been brought before the children, not only has Nature's door been opened to them, but they have made a step into the realm of literature, from which none of them will voluntarily turn back.

Introduction to Studies on the Fertilization of Plants.

Maurice Ricker.

The subject of fertilization in plants is introduced by a consideration of the life history of an oak. This tree is usually well known, as a tree. Some have shown surprise that it has a flower and thus I am able to obtain the interest and attention, so necessary in the treatment of a nature study subject To go to the complex forms of adaptation at one bound would fail to give those who are wholly without botanical training the necessary insight into the anatomy and physiology of flowering plants. This treatise is an attempt to put this necessary information into words of one syllable, as it were.

Let us begin the study of an oak with the beginning of the plant, not as a separate individual, but with the formation of the mother cell which is afterwards to give rise to the plant. Brown and Mohl about 1840 showed that all organs were traceable to the one cell from which all the others are formed. During the past fifteen years some of the foremost biologists have devoted much time to the study of the cell. They have written many volumes and worked out many interesting things, even to some interesting studies of the difficult problem of inheritance. But we shall have little time for the consideration of their conclusions. It will suffice for our present purposes to restate the proposition of the ancients, "Like produces like." A black oak tree originated from an acorn borne upon a black oak tree. Of course the exception, so firmly believed in by all small boys, of the snake being produced from the horse hair, has to be dealt with. True the boy has not proved this by his own experiment. The one he tried was planted in the wrong time of the moon or in the wrong kind of a bottle, but he always knows some one who did grow a true snake from a horse hair.

Aristotle taught that life originated from ocean slime. He was unable to find proof of any material change in species. The last great pre-Darwinian battle was fought in the debate in Paris between St.Hilaire and Cuvier less than a week before the revolution of 1830. Cuvier won, at this time, by stating authoritively that skeletons show no change in form, even of the cats buried 3,000 years before, with mummies in Egypt. He overlooked the fact that conditions of environment which might lead to change in structure had remained constant likewise during the same length of time. We may defer the discussion of change and state that black oaks come from black oaks, white oaks from white oaks, burr oaks from burr oaks—let us see how.

We readily find the small yearling oaks under the parent tree. On pulling them up we find the well known acorn. We know this acorn grew upon the tree above. If it is spring-time we find no ripened acorns on the living limbs, but the dead branches broken by late summer winds give the proof, if any is needed.

Closer observation of the black oak reveals the little miniature acorns on the previous year's growth, in the axils of the leaves. It would require little reflection to see that these are the acorns to ripen in the fall.

In similar positions on the fresh young shoots of this spring's growth, in the axils of young leaves, may be found corresponding structures one year younger. The fleshy growth with the three reflected lips is the female flower. But 'what a flower!' I exclaimed, when I first saw it. It is devoid of the showy envelope which we associate with this word. A perfect flower is one that has both pistils and stamens; that of the oak has a pistil only, or anthers only. It is therefore an imperfect flower. A flower with both pistils and stamens and both whorls of the floral envelope—the outer one, the calyx and the inner, the corolla—is called a complete flower. Such is the apple blossom.

The sticky surfaces of the three lips are the stigmatic surfaces and the part bearing them—the stigma. The swollen attached end is the ovary. The stem connecting the stigma with the ovary, in this case quite short, is the style.

Sections of the ovary show that the exterior part is a covering for the seed like ovule. By proper methods we could go further and demonstrate the germ cell itself which is in reality the center of life and the cell from which the future oak is to spring.

Near the attached end of the ovule is a small opening into the ovule called the micropyle. By the provisions of nature no plant germ cell can divide and grow into an embryo without the introduction through this micropyle of the growing pollen tube. This pollen tube can grow only when a ripened grain of pollen produced on the anther of the same or another flower, falls upon the stigmatic surface of the pistil when it is in a receptive state. The conditions under which fertilization takes place, for this is the name given to the process just described, form an interesting chapter in plant morphology and plant physiology.

It is my purpose to call your attention to some of the wonderful adaptations in plants and animals which are evidently solely for the purpose of transferring the ripened pollen to the receptive stigmatic surface.

Let us take up the case of the oak. As was stated, the fruit bearing oak is imperfect, and consists of a pistil only. We must look for another flower,. therefore, which shall contain the stamens,. We call the pistil just examined the pistillate flower,. Let us look for the stamens or the staminate flower. In some cases we must look on another plant. When pistillate and staminate flowers are found on separate plants we have a dioecious plant. In the black oak we find the staminate flowers on the preceding year's growth in the axils of leaves. Such flowers are called monoecious.

If you examine the long catkins or aments it will be found that the stamens are borne upon a long stalk. When viewed through a lens a beautiful structure is disclosed. Each stem bears numerous flowers and each flower contains four stamens.

The drawing (Fig. 6) shows the anther on the pollen bearing part,

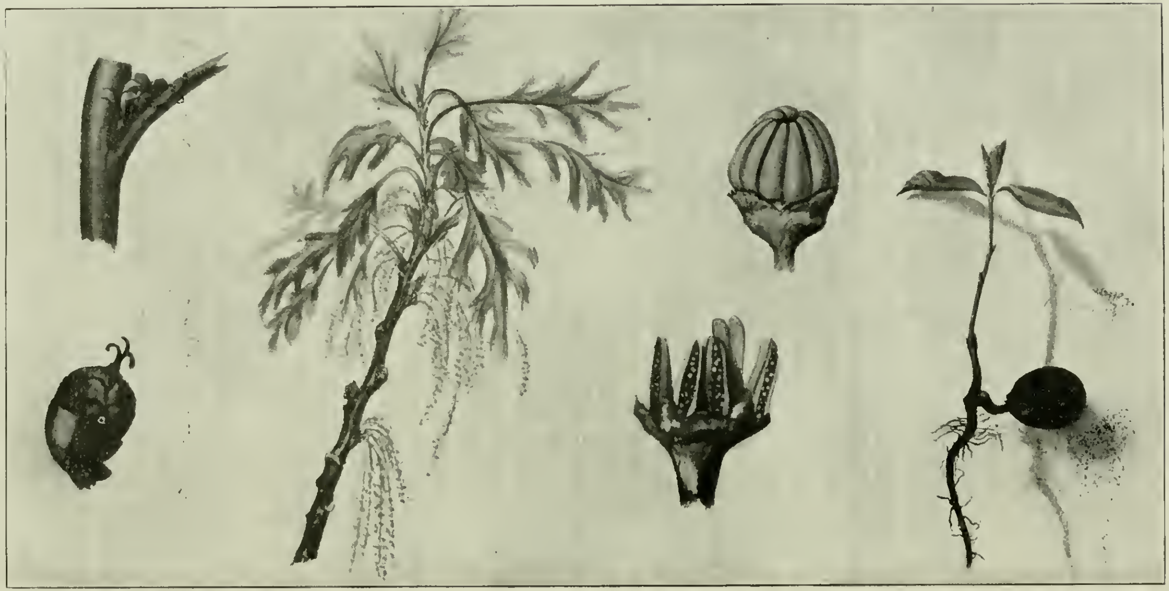


Fig. 6. The stages of the black oak. On the right, an acorn with young shoot; on the left, young acorns in the axil of a leaf above, fullgrown acorn below; branch with aments; on the right of the branch the unripened stamens above, mature stamens with pollen below. From water color drawings by Mrs. Edith Ricker.

before it has ripened and after it has dehisced or opened, setting the pollen free. The meally yellow dust that is shed so freely at the slightest touch is the pollen. Shaking the branch sets free a perfect cloud of it. It is borne off in the air like a whiff of smoke. Only one pollen grain is necessary to fertilize one ovule. Many pollen grains will of necessity, whatever be the mode of fertilization, fail to reach their intended place upon a ripe stigma. The ratio of pollen grains to the ovules must always be large. The night blooming Cereus has 250,000 pollen grains to 30,000 ovules, or about 8:1. The garden wistaria has a ratio of about 7,000 to 1 ovule. The Indian corn, pines and other wind fertilized flowers must have a much greater ratio than this.

One can see at a glance (Fig. 6) that the pollen grains of the oak, because of their position, stand little chance of falling upon the stigma of the branch upon which they are borne. It would require an upward draft of air or an insect or other animal to carry them. It would be easier to account for the transfer of the grain of pollen in this case by supposing it to have dropped gently from the boughs above. It may as well have been carried by a light breeze from a neighboring tree.

There is neither odor, nectar, edible pollen, nor showy corolla, to guide or attract a busy insect, and since all insects seem bent on business they would spend little time loafing around the oak blossom. In fact it would be a one-sided bargain for an insect to carry pollen for the oaks since he would derive no benefit to himself. Wherever a relationship is discovered between a plant and an animal it may be taken as axiomatic that the association is mutually beneficial. Darwin once staked his theory of organic evolution upon the proposition that if any organ or modification of an organ could be found in the animal or plant world that was present wholly for the benefit of another species, that he then must admit that his whole conception might be based upon false conclusions. Fifty years have passed and no one has produced the evidence.

Assuming that a pollen grain has found its place upon a sticky stigma of a pistillate flower let us see what takes place. The grain of pollen absorbs moisture and swells until it begins to grow a tube, somewhat as a seed sends down its radical. It either enters a space left between the cells or by penetrating the cells grows until it reaches the generative cell of the ovary. An interesting series of experiments has been made showing the cause of growth down the style to the ovule to be chemotaxis, or growth toward chemically attractive substance. The essential part of the pollen liquid now penetrates the ovule to the nucleus of the generative cell. There immediately follows an interesting series of phenomena of especial interest to the embryologist. In brief, the one cell subdivides many times and grows ultimately into an acorn, which one year later will be recognized as such a one as now appears on last year's growth. The season's growth increases it to the normal size and in September or October it is ripe and ready to leave the tree, and soon finds its resting place upon the ground. (The white oak and some others mature their acorns in one season. Not all the pistils are fertilized. Some of the acorns fail to grow the second year.) The fallen acorns roll about or are kicked or carried about by animals. Squirrels bury them at some distance from the tree. A great number are eaten by animals. Many others have been stung by diptera and a little white grub has eaten the food stored up for the plant.

But here and there one in a great many has been pressed into the ground and has felt the warmth of spring. It has split its weather worn casing and protrudes its white radical. The subtle attraction of gravity causes it to turn downward and bury itself still deeper in the earth. From the split in the hypocolyl where it branches to the two cotyledons arises the caulicle or stem. This is the part we will call the tree. The figure (Fig. 6) shows an oak the second year of its growth as an independent plant, or the fourth year from its beginning as a cell.

We will not here treat further of the growth of the tree. To consider in its entirety the manner of growth to the tree again producing acorns would be a treatise on botany too long to be given here.

We have traced the growth through the stages through which, in a general way, all plants of the higher orders must go.

The Forest Trees.

Harry Nichols Whitford.

(The material contained in this and the other botanical lectures is the outcome of a series of talks given at the biological station of the University of Montana at Bigfork, Montana, during the summer of 1902. The description of the conifers is intended to be an aid to the identification of the trees for the use of those not acquainted with botanical terms. In nearly all cases the points of difference between the trees have been tried and found applicable in determining the species. In the preparation of the key and descriptions, the author has made free use of the manuals covering the region and of Sargent's "Sylva of North America.")

An attempt has been made to show why there are **prairie** and **forest formations.** In the **forest formation** itself there are places where there are no trees, and in certain situations some trees will grow where others will not. It will not be out of place to ask why these things are so. But before proceeding, it is desirable to become acquainted with the kinds of trees that are found in the state. This enquiry will be confined to that group of trees called conifers, for the others form an inconspicuous part of the forest. Not only must the trees be known, but also their habits, so that what they will do in certain situations can be predicted.

It is not always an easy thing to distinguish the different species of trees. The difficulty of recognizing young trees from one another is even greater than with older trees; for the older trees may have cones, and these are, of course, more apt to give a clue to the identification. However, even from older trees cones are often absent. The bark of trees is very characteristic, and lumbermen use this mark to distinguish trees. But hereby mistakes are often made, for the bark is different at various ages; and a tree growing in one situation is likely to have different bark from the same species growing in another situation.

The leaves perhaps are less variable in their form than the bark, and as they are more often present than the cones, they will serve as a criterion in discriminating the species. With the exception of the western larch, the leaves of the conifers to be described are on the trees the year around, so the character drawn from them can be used in the winter as well as the summer. Since the leaves even on the same tree vary in shape, often more than one character will have to be used.

A Key to the Conifers of Montana.

A. Trees with leaves in clusters, excepting those first appearing on young shoots.
  I. Leaves in clusters of more than five........1. Larix (larch).
  II. Leaves in clusters of two to five..........2. Pinus (pines).
B. Trees with leaves not in clusters.

I. Leaves scale like.

a. Leaves four ranked, the side ones ridged, the branchlets thus appear flattened ....3. Thuya (arbor-vitae).

b. Leaves four ranked and all ridged, the branchlets thus appear four sided ....4. Juniperus (juniper).

II. Leaves needle like.

a. Leaves jointed from a base that remains after the leaf is shed.

Leaves flat, petiolate ....5. Tsuga (hemlock).

Leaves sessile, and ridged on both sides............ ....6. Picea (spruce).

b. Leaves not jointed from a base that remains after the leaf is shed.

Leaves short petiolate leaving a triangular scar when shed ....7. Pseudotsuga.

Leaves sessile leaving a round scar when shed...... ....8. Abies (Fir).

The genus **Larix** is easily distinguished from the other genera by the fact that it is the only deciduous conifer in Montana. There are two species in Montana.

Western Larch (1) (**Larix occidentalis** Nutt.):

This tree is known in the Flathead valley as the tamarack or larch. The new shoots have the leaves scattered. In the axils of these leaves appear buds which develop into short branches with a cluster of leaves at the end. Each year this short branch grows slightly in length, and a new ring of wood is added. The growth in length is so little, however, that the branchlets never become long. The leaves are soft compared with the other conifers, and have a lighter green color by which they may be distinguished in the forest. In the fall they turn yellow green and drop about the middle of October. The leaves are about one and a half inches long. Compared with those of other conifers the cones are small, but are about twice as large as the eastern tamarack (**Larix laricina** (Du Roi.), Koch.) They are from one to one and a half inches in length. The bract is longer than the scale. (2)

The bark (Fig. 7) of the older trees is smooth at first, then becomes deeply ridged, and when the tree is 75 to 100 years old, it is at the base four to five inches thick. It breaks up into oblong plates and is covered with scales which break off in scroll shaped patterns. These scales are

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(1) In this article the common and scientific names suggested by Sudworth of the United States Bureau of Forestry will be used. Nearly all of the western conifers have closely related species in the eastern part of the United States, and many have the same common names as their eastern relatives. It is desirable, therefore, to distinguish them by choosing a name that is not already in use. However, with these there will be given other common names that are in local use. See Sudworth, G. B., Check list of the forest trees of the United States, their names and ranges. Bull. No. 17, U. S. Dept. of Ag., Div. of Forestry.

(2) It may be well to state that the fruit of the conifers, known as the cone, is made up of closely imbricated scales. To the upper surface of each scale, two seeds are attached; on the lower surface, "bracts" are found. Usually the bracts are shorter than the scales.

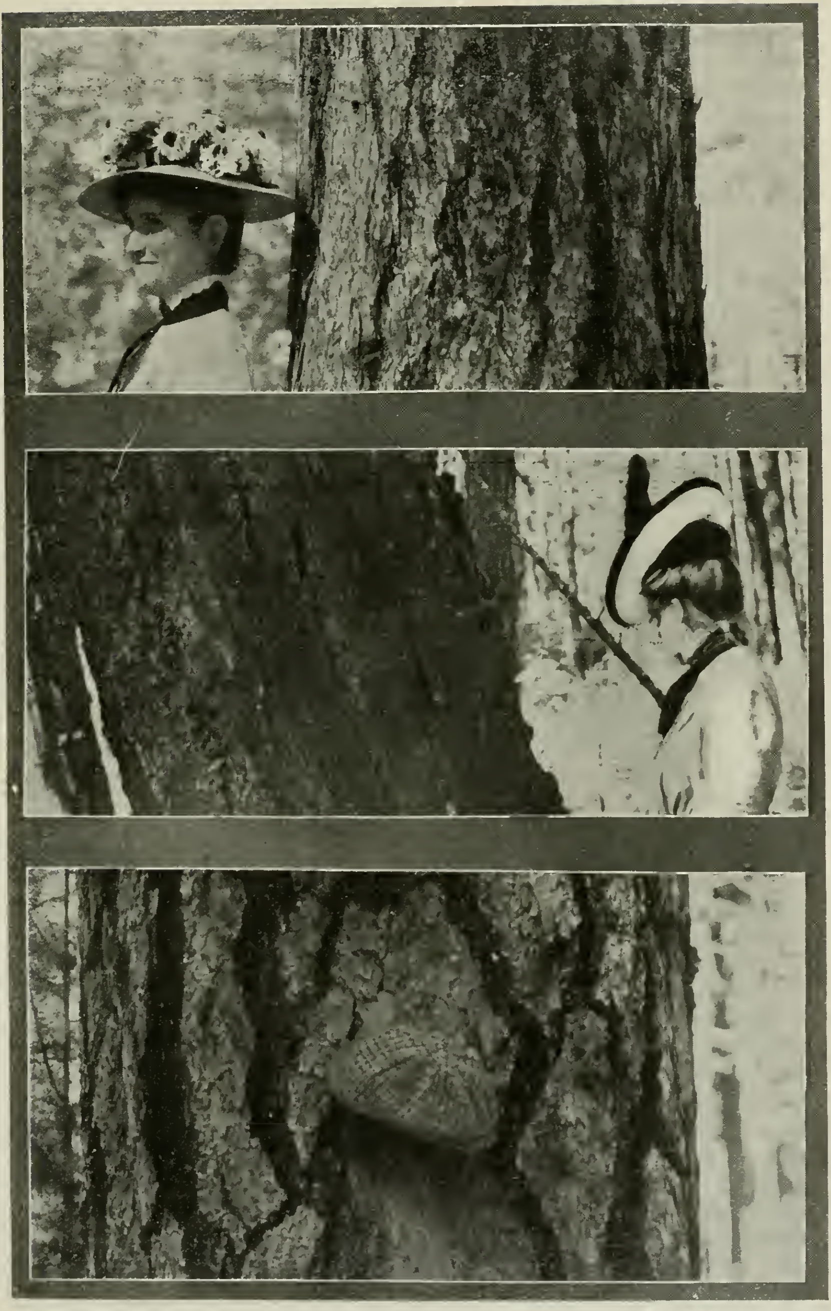

FIG. 7. Comparison of bark. Upper, tamarack. *Larix occidentalis* Nutt; middle, Douglas spruce, *Pseudotsuga taxifolia* [Lam.] Brit; lower, Yellow pine, *Pinus ponderosa* Laws.

cinnamon red in color. The thick bark enables the tree to resist fires. This is, of course, of great advantage to the tree, for since fires have become more numerous, those trees that are easily destroyed by them are first excluded from the forest. The western larch is one of the last to suffer permanent injury from fires. Those seed-bearing trees that remain after fires will re-stock the burn with a new generation of trees. The western larch requires light in its seedling stages; hence it can reproduce itself only in open places. These may be caused by fire, by death of old trees, or by any accident that will remove the trees of the mature forest. The western larch is then exceedingly intolerant of shade.

In the Flathead valley the western larch does best in soil not too moist nor too dry. This tree is said to reach its greatest development in the basin of the upper Columbia river. In the United States it is most at home in the Flathead valley, and in northern Idaho. Here it may reach the height of 200 feet, with a trunk of five to six feet in diameter, and occasionally is even larger.

Mountain larch (Larix Lyallii Par.). The mountain larch is reported to be present in a few places at high altitudes in the mountains of northwestern Montana. It does not, however, form a conspicuous element in the forest. It is distinguished from the western larch by the fact that the leaves are nearly as thick as broad. In the latter species the leaves are somewhat wider than thick. The branchlets of the mountain larch are hairy, as compared with those of its lowland relative. The height of the tree is seldom over fifty feet.

The genus **Pinus (pine)** is easily distinguished from the other conifers by the fact that the needle like leaves are in groups of two, three, or five. The first leaves that are produced on the leading shoots are scale-like. In the axil of each scale-like leaf a bud may appear which develops soon into a branch, so short and inconspicuous as to be hardly recognizable. On each of these short branches, two, three, or five leaves appear, the number being usually definite in each species.

There are five species of pine in Montana. They may be divided into two groups, viz., those that have two or three leaves in a cluster or fascicle and those that have five leaves in a cluster. The latter, known as white pines, are represented by three species in Montana, and are seldom found growing together. In the Flathead valley the **silver pine** is found only in the lower altitudes. Near the timber line is the **white-bark pine**. (Plate XLVII.) This is usually on the west side of the continental divide. On the east side of the divide at high altitudes, the **limber pine** occurs. Aside from their mode of distribution, these three pines may usually be distinguished from one another by the length of their cones. The cones (Fig. 8) of the silver pine are from five to eleven inches in length, usually not less than eight; those of the limber pine from three to ten inches, most frequently under eight; and those of the white-bark pine from one and a half to three inches. The tips of the cones of the last named species are curved inward. The length of the leaves is variable, but usually in the silver pine they are long, in the white-bark pine and the timber pine they are short; the first of the last two named having the shorter leaves.

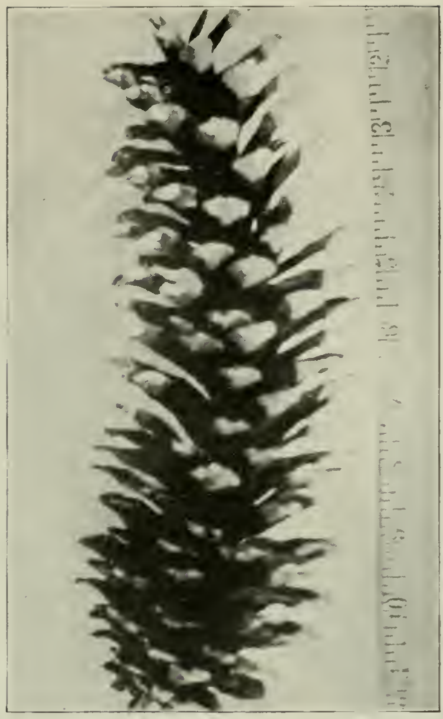

FIG. 8. Cone of Silver or White pine.

Silver pine (Pinus monticola, Dougl.): This pine is more frequently known as the white pine, or western white pine. It resembles very much the **white pine** of the eastern part of the United States. The cones of the former are much longer than those of the latter, and the leaves are more thick and rigid, and usually not so long. No tree in Montana has longer cones (Fig. 8) than the silver pine. The leaves of the silver pine are said to remain on the tree from three to four years. The trunk of the young trees has a smooth, thin, light gray bark. In the older trunks it becomes as much as an inch to an inch and a half thick, and is divided into nearly square plates which are very characteristic. When fired, the bark, is easily heated through, the cambium zone (3) is killed, and the tree thus destroyed. In contrast with the western larch the tree is slightly tolerant of shadé, that is, it can exist as a seedling in the shade of other trees. In the Flathead valley it is confined to soils that are quite moist. It cannot be said to be a very successful tree here, although in favorable situations it reaches good size. Isolated trees may be found at rather high altitudes, although it was not seen to overlap in its distribution the white-bark pine of the higher altitudes. It is said to reach its best development in the bottom-lands of streams tributary to Lake Pend d'Oreille.

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(3) The cambium zone is the active growing region between wood and bark that enables the tree to increase in diameter; in the bark and therefore outside the cambium zone is the region that conducts certain food materials from the leaves to the roots. If these regions be killed, the tree will shortly perish.

The **white-bark pine (Pinus albicaulis** Engelm.): It is distinctly an alpine form. (Fig. 9.) The leaves are in clusters of five, and from one and a half to two and a half inches in length. They are said to persist for from five to eight years, most of them remaining on the trees from seven to eight years. The bark is very thin. It is quite smooth and is creamy white in appearance, hence the name **white-bark pine. It is** easily destroyed by fire. The white-bark pine grows on the most exposed ridges in high altitudes. It is confined to the western continental divide, where it is usually associated with the alpine fir.

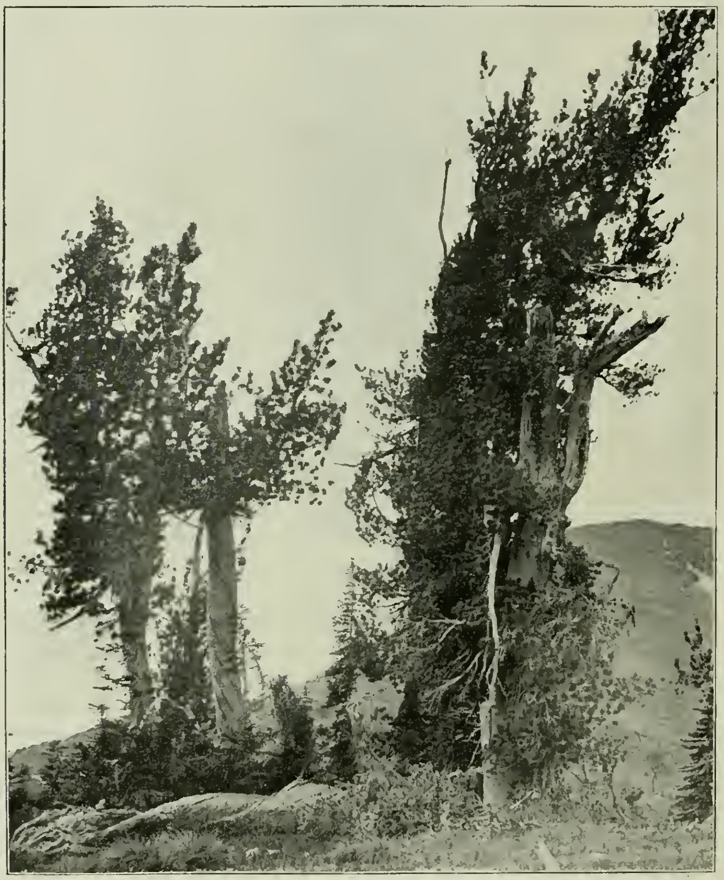


Fig. 9. White-bark pine on the slope of Sinyaleamin Mountain, at altitude of 7800 feet, showing the struggle they make for an existence. Photo by Prof. L. A. Youtz.

The **limber pine (Pinus flexilis** James): The tree may usually be distinguished from the former species by its rougher bark and longer cones. It is found on the eastern side of the continental divide, usually at altitudes of from 5,000 to 10,000 feet.

The two remaining pines found in Montana are the **bull pine** and the **lodgepole pine.** They can be easily distinguished by the length of the leaves and the number in a cluster. The former has usually three, sometimes two, long leaves; the latter, two shorter leaves.

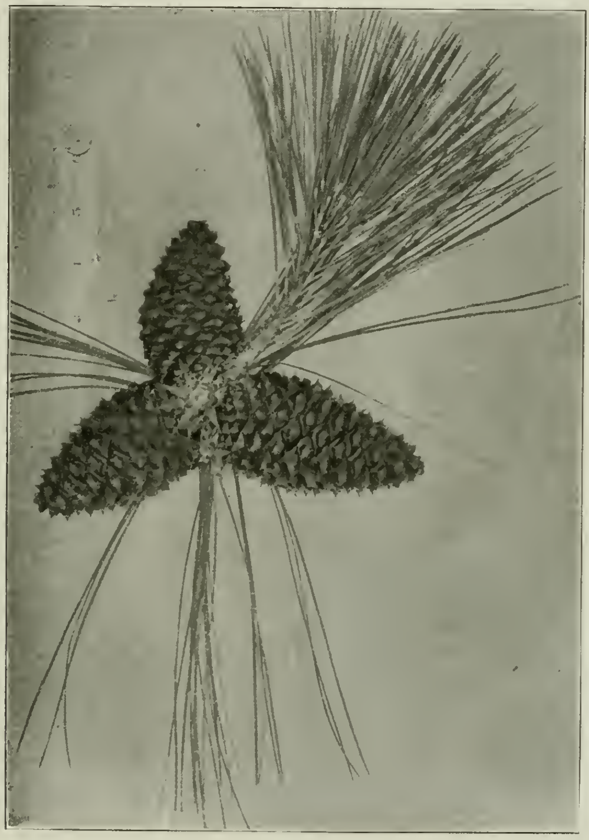


FIG 10. Leaves and cones of the bull or yellow pine. Photo by M. J. E.

The **bull pine (Pinus ponderosa** Laws.): The bull pine, (Fig. 10) more often called yellow pine, is one of the most striking, widely distributed, and most valuable trees of Montana. The comparatively long leaves are usually in clusters of three, though occasionally two are found. They persist usually for three years. They form great clusters at the ends of the naked branches. The cones (Fig. 10) of the bull pine are three to six inches long, and often in clusters of three to five. The tips of the bracts are elongated into awnlike characteristic spines. The bark is very striking. (Fig. 7.) In the older trees it is split up into long rhomboidal plates, covered with scroll-like yellow scales, very much resembling those of the western larch. At this stage the tree is known by certain lumbermen as the **yellow pine.** In the younger trees the bark is more ridged and rounded, and does not have the yellow color. This form goes under the name of **bull pine.** In the older trees the bark is two to four inches thick and very resistant to fires.

In the Flathead valley the tree is confined to the low altitudes, and is more abundant on the border of the prairie, though it does better in moister situations. It is, perhaps, shaded out of these places because of its extreme intolerance of shade. It needs very open places in which to germinate, and very little shade will prevent this. The bull pine and its closely related form, the **rock pine (Pinus ponderosa scopulorum** Engelm.), are found throughout the western part of America. The latter has not been reported from Montana.

The **lodgepole pine (Pinus Murrayana** "Oreg. Com."): The leaves of the lodgepole pine are in pairs one to two inches long, and remain on the trees seven to eight years. The cones are smaller than those of any other pine in Montana. The tree resembles the **jack pine (Pinus divaricata** (Ait.) Du Mont de Cours.) of the eastern part of the United States in its general appearance and some of its habits. The bark of smaller trees is smooth. On the older trees it breaks up into rectangular plates, and is about one inch in thickness. It is a tree easily destroyed by fire, but because it can produce cones at a very early age, it has a very great advantage over the other trees in gaining a foothold in burned areas. Groves of small trees six to ten years old may produce cones abundantly. Another remarkable feature of the lodgepole pine, is that the scales of the cones remain closed, sometimes for several years, thus preserving the vitality of the seeds for a comparatively long period. The seeds from cones nine years old have germinated. The heat of the fires sweeping through a forest will open cones, liberating, though not often destroying the seeds, which germinate at once, and thus give a decided lodgepole pine aspect to the new growth. In closed forests the lodgepole pine has small diameter and great length. Trees over a hundred feet tall often are no more than six inches in diameter. Where there is plenty of room for the lodgepole pine to grow the dameter is greater, and the height less. The lodgepole pine has a rather wide distribution in western Montana. It is usually confined to rather moist situations. So successful has it been in gaining a foothold after fires, that it has replaced many square miles of valuable timber. It cannot tolerate shade, however, and if fires are kept out, in several generations the forest conditions will probably be the same as before the original forest was destroyed.

The **giant arbor-vitae** and the **Rocky mountain juniper** are easily distinguished from the remaining conifers by their scalelike leaves. In the giant arborvitae they closely overlap. In the Rocky mountain juniper they do not overlap so closely.

The **giant arbor-vitae (Thuya plicata** Don.) **(Thuya gigantea** Nuttall): This tree resembles its eastern relative the arbor-vitae **(Thuya occidentalis** Linn.) very closely, both in appearance and in habits. (Fig.

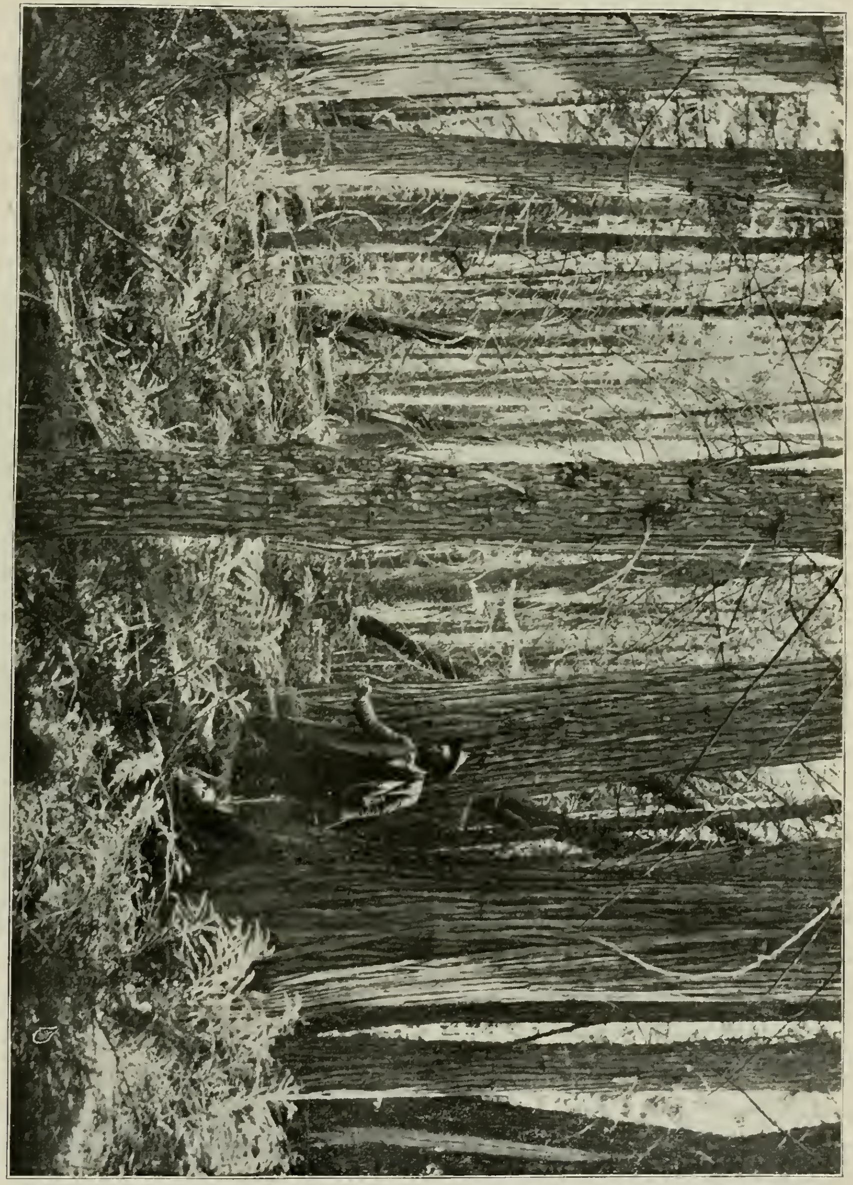


FIG. 11. Arbor vitæ forest at the inlet of Sinyaleamin Lake, Mission Mts. Photo by J. M. Hamilton.

11.) The cones are considerably larger than in the latter, and there are six scales that bear seeds, instead of four. Other common names for the giant arbor-vitae are red cedar and cedar. The leaves on the side branches are opposite, scalelike, about one-eighth of an inch long. They overlap very closely, and fall usually in the third year. The cones are one-half an inch long and ripen the first season. The bark (Fig. 11) is one-half to three inches thick, and is irregularly divided into broad ridges which have long shredded scales. The tree is said to resist fires fairly well, and can tolerate shade. It is not frequent in Montana, and is confined to moist situations on the western slopes of the Rocky mountains in the northwestern part of the state. It reaches its greatest development on the Pacific coast.

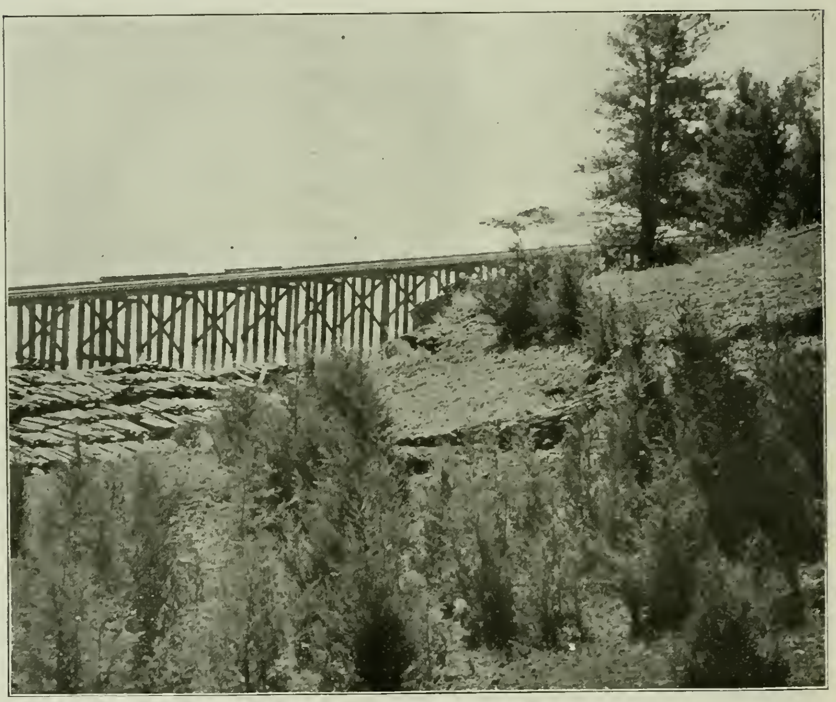


FIG. 12. Growth of young Rocky Mountain Junipers on the bank of Flathead lake, near the O'Brien mill. Photo by M. J. E.

The **Rocky mountain juniper, (Junipers scopulorum Sarg.)**: The Rocky mountain juniper is called frequently cedar or red cedar. It resembles its eastern relative (**Juniperus Virginiana** Linn.) though the fruit is larger and matures in two years instead of one. The leaves are opposite and do not overlap so closely as in the giant arbor-vitae. The bark is about one-half an inch thick and has thin shreddy scales. The cones, commonly known as "juniper berries," bear two or three seeds. This tree is common on the borders of Flathead lake, (Fig. 12.) and is found in various parts of the state.

The **western hemlock (Tsuga heterophylla** (Raf.) Sarg.): This tree, commonly known as the hemlock, differs from its eastern relative (**Tsuga canadensis** (Linn.) Carr.) in having slightly larger cones with scales longer than broad. In the eastern species the scales are nearly as broad as long, and the cones have a stalk, whereas the cones of the western species are sessile. The leaves are rounded at the apex, flat, dark green above, white below, and have short leaf stalks, or petioles. The bark on full-grown trees is about one and a quarter inches thick and has rather broad flat connected ridges with brownish scales. The tree, like the giant arborvitae, is very tolerant of shade. It is even more restricted in Montana than the giant arborvitae, and like it reaches its best development on the Pacific coast. (Fig. 13.)

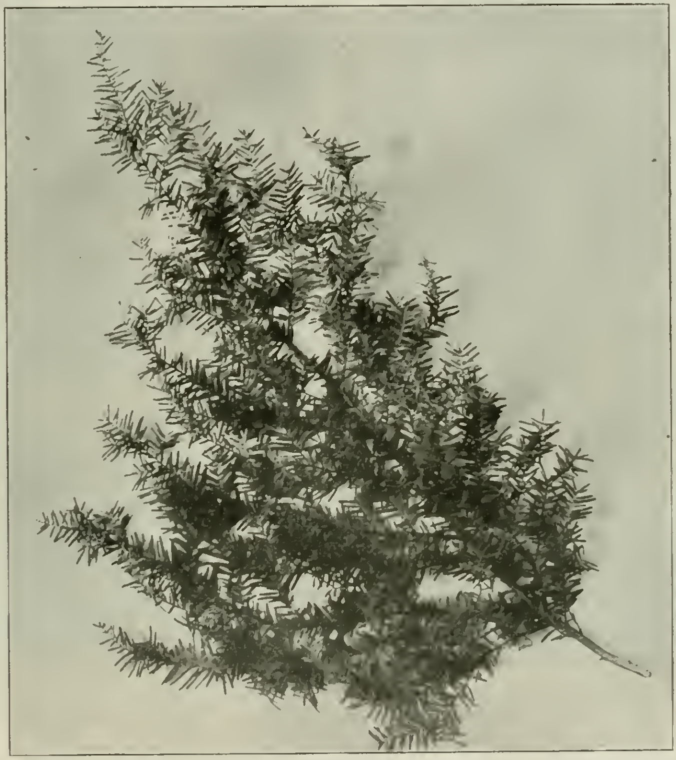


FIG. 13. Leaves and cones of the western Hemlock. Photo by M. J. E.

The young trees of the **Douglas spruce, lowland fir, Engelmann spruce** and **Alpine fir** look alike to the uninitiated. The last named species is not often associated with the others, and hence is not so likely to be mistaken for it. The base of the leaf of the Engelmann spruce is woody, and remains attached to the stem after the leaf is shed, thus leaving peglike projections on the stem. The spruce can be easily distinguished thereby from the other three trees. The western hemlock, however, has these peglike projections also, though they are not nearly so prominent. The leaf of the spruce is roundish in cross section, while that of the hemlock is more flattened. The leaves of the side branches of the lowland fir are dark green above and usually conspicuously notched at the end, while those on the side branches of the Douglas spruce are light yellow when young, usually dark green when older, and not notched at the end. The scar left by the former when the leaf is shed is round, while that left by the latter is more triangular in shape. The leaf of the former is sessile, and that of the latter has a very short leaf stalk. The cones of the Douglas spruce (Fig. 14) and Engelmann spruce hang down, while those of the firs are erect. The cones of the Douglas spruce have the bracts longer than the scales which easily distinguishes it from the Engelmann spruce.

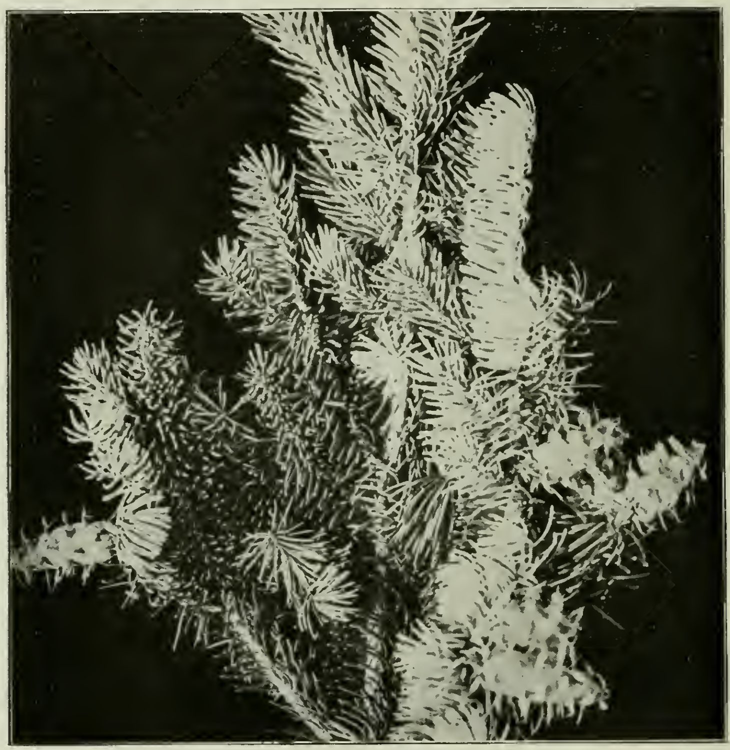


FIG. 14. Leaves and cones of Douglas spruce or lowland fir. Photo by M. J. E

The **Engelmann spruce (Picea Engelmanni** Engelm.): This tree closely resemble the **white spruce** of the east (**Picea canadensis** (Mill.) B. S. P.) Indeed the white spruce is said by some authors to be found in Montana, though others doubt its existence here. If it is found, it is difficult to distinguish it from the Engelmann spruce. The leaves on the lower branches are usually short, stout, roundish in cross section, sharp pointed and a dark blue-green in color. They persist about eight years. The cones (Fig. 15) are about two inches long, sessile or very short stalked. At first they are horizontal but later drop. They mature at the end of the first season. The bark is thin and broken into large flaky scales. The tree on account of its thin bark, is easily destroyed by fire. It tolerates shade fairly well. It reaches its best development in moist situations, in swamps, along streams, and on moist hillsides. Outside of Montana it has a wide range in the western part of the United States and British America, usually in rather high altitudes.

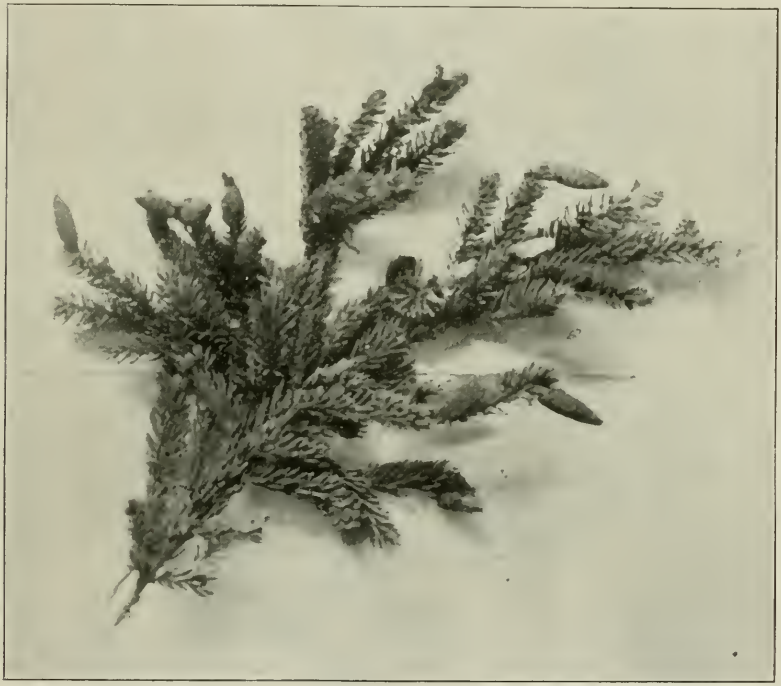


Fig. 15. Leaves and cones of Engelmann's spruce. Photo by M. J. E.

The **Douglas spruce (Pseudotsuga taxifolia** (Lam.) Brit.) **(Pseudotsuga Douglassii** Car.): This tree, also known as the red fir, is neither spruce nor a fir, the name **Picea** being reserved for the former, and **Abies** for the latter. The word **Pseudotsuga** means literally "false hemlock," but the name has little or no significance.

The leaves of this tree have already been described. They remain on the tree about eight years . The cones, (Fig. 14) as already stated, are easily characterized by the fact that the bracts are longer than the scales. They vary in size from two to four inches. The bark (Fig. 7) of the tree varies greatly as the tree ages. In the older trees it is composed of large, broad, irregularly connected ridges. The bark is very thick at the base, usually from six to twelve inches, and even in exceptional cases two feet. By its thick bark (Fig. 7) the tree is well protected from fires. It does not tolerate shade. In this respect it may be classed with the western larch and lodgepole pine. In the Flathead valley the tree is associated with the western larch in moister soils and with the bull pine in drier soils. It does not, however, reach the dimensions here that it does on the Pacific coast, where, with the western hemlock and arbor-vitae, it forms luxuriant forests. The Douglas spruce is distributed throughout the western part of the United States, but in dry climates it is small and stunted in growth.

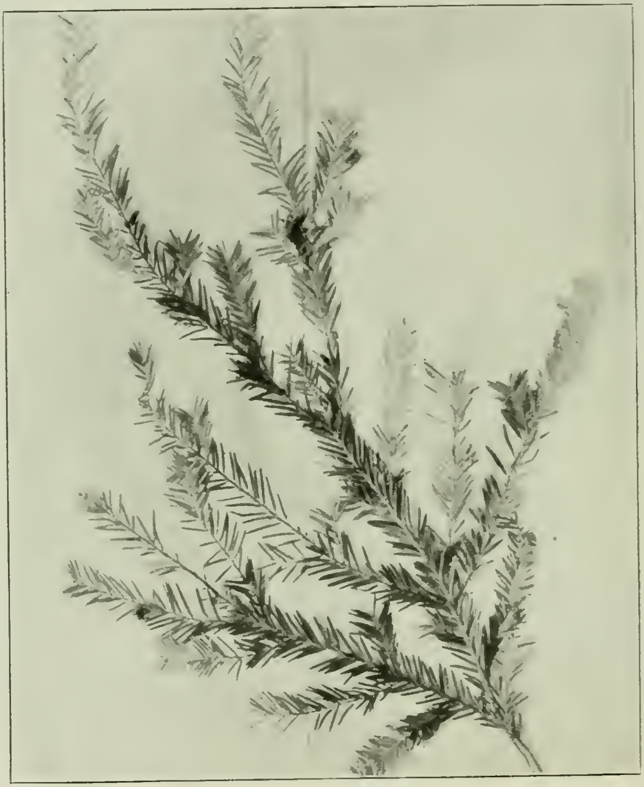


FIG. 16 The Yew, showing leaves and berries. Photo by M. J. E.

The **lowland fir (Abies grandis** Lind.): This tree is also known as the white fir and the balsam fir. The leaves have already been described. On the horizontal branches they are conspicuously two ranked. They persist from eight to ten years. The cones are erect on branches near the top of the tree, and vary in length from two to four inches. The scales of the cones, as in all firs, are deciduous, the cone axis being shed later. The fruit matures in one season. The bark is smooth at first, with the characteristic balsam blisters. Later the bark splits into low flat ridges, giving it the name of "rough bark fir" in some sections of the country. It is sometimes two inches thick, though usually thinner. The tree tolerates shade fairly well. It is not at home in the Flathead valley, though in favorable places it reaches comparatively large dimensions. Like so many of the other conifers it does its best on the Pacific coast. It is confined to low altitudes, seldom reaching above 3,500 feet.

The **alpine fir (Abies lasiocarpa** (Hook) Nutt.): This tree is also known as the balsam fir. The leaves of the lower branches resemble those of the lowland fir, though in trees growing side by side those of the alpine fir are narrower and lighter green than the leaves of the lowland fir. The cones are much alike also. The seeds have bright violet wings and can thus be easily distinguished from the pale colorless wings of the seeds of the lowland fir. The bark of the lowland fir is grayish or reddish brown, while that of the alpine fir is much lighter. The bark of the former is also much more ridged than that of the latter, which remains more or less smooth until very old age. The alpine fir, as its name implies, is a tree of the alpine regions. It does its best, however, in damp canyons, where it is associated with the Engelmann spruce. In the higher altitudes it is a companion of the white-bark pine on the exposed ridges, but is more at home in basins, occupying the places where the snow disappears first. It is found throughout the alpine regions in the western part of the United States, and reaches as far south as northern Arizona. (See frontispiece for characteristic locality for growth. On the extreme right is the tapering top of a beautiful tree.)

Daphnia Pond.

A STUDY IN ENVIRONMENT.

Morton John Elrod.

Daphnia Pond lies along the road about a mile and a half south of the laboratory. It is a small land locked pond, covering some 10 or 12 acres. It is undoubtedly of glacial origin, lying in a small pocket between two ridges of rock made by faulting. Its outlet in spring is to Flathead lake, a hundred feet lower in altitude. The pond lies in a glaciated region and is no doubt the result of glacial action. Within a few miles of Daphnia a dozen other ponds of similar nature may be found with similar origin, and offering the same field for study.

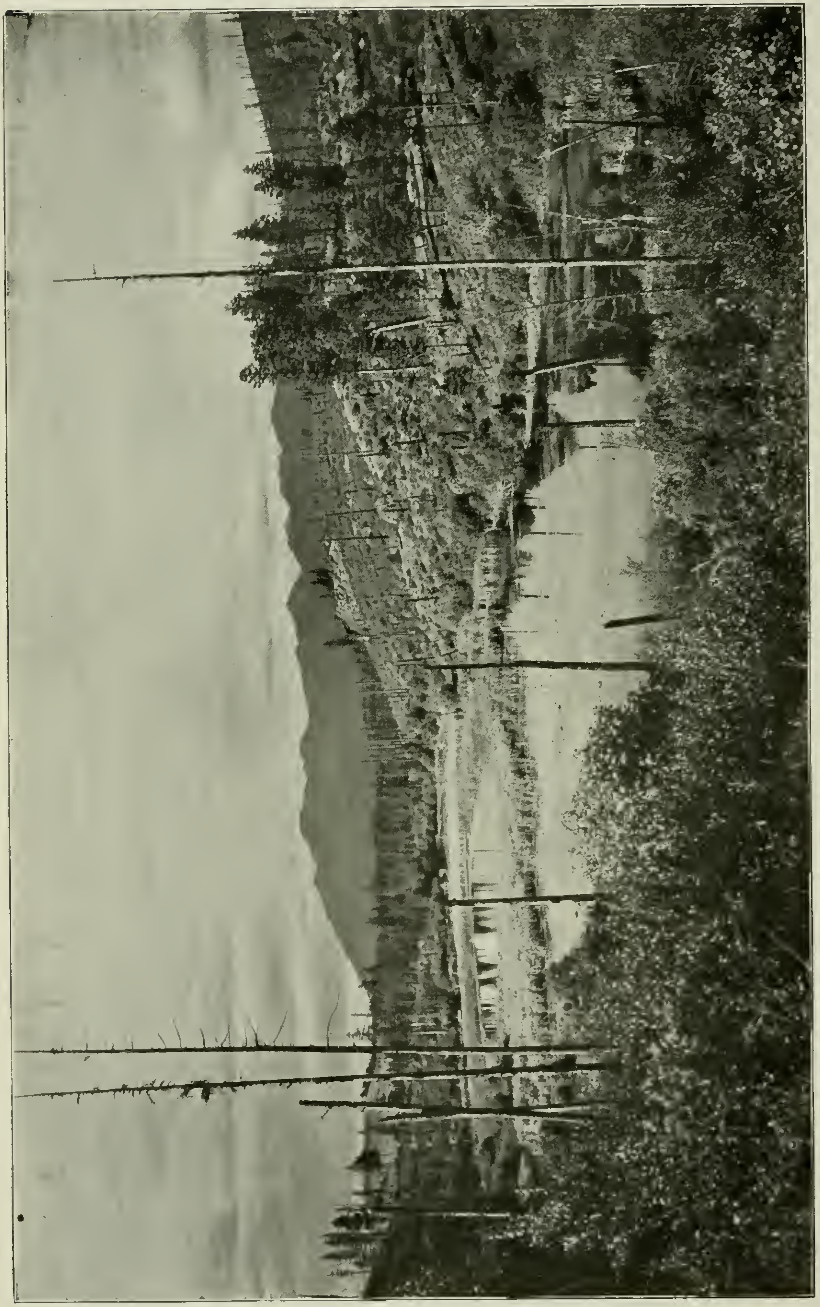
The pond is shallow at either end and 20 feet deep in the middle. The shallow places are overgrown with rushes, moss, water lilies, and other aquatic forms of vegetable life. A small place in the center has open free water. Around the banks there is the usual growth of willows, while numerous logs and dead bushes make the water difficult to reach. The bottom is largely of boulders, filled in between with mud, and overgrown with rank and dense vegetation.

The name Daphnia was given because of the great numbers of the entomostracan **Daphnia pulex** found in the pond.

Environment is a biological term having reference to the physical conditions affecting an organism. As referred to human beings we say the environment is good when the conditions are so favorable as to lead to good results. When a boy is sent to college he is in a good environment if his professors, his associates, his boarding house, and his companions all encouarge him to such effort as will bring about the best results mentally, morally, and physically.

The environment may, of course, be bad. In that case the results are not what are desired. Bad companions and associates, bad tendencies, may bring about conditions of mind and body disastrous to the individual possessing them.

According to the best information we now possess, when an organism comes into existence it has certain hereditary tendencies. These are only tendencies, and are immediately intensified or diminished by the conditions in which it is placed. In addition to these hereditary tendencies each living organism has within itself, be they few or many, some characters which are called acquired characters, which originate within the organism, and are affected the same as hereditary characters. Often these are powerfully influenced by environment, are intensified to a marked degree, and apparently modify the entire life of the species and its descendants. Hereditary or acquired characters or tendencies, affected by environment, make the species what they are.



Daphnia pond, near the station. Note the hydrophytic vegetation with open water in the middle. Swan range in the distance. The view is north. Photo by M. J. E.

Environment may mean any of the following conditions: Physical conditions, temperature and moisture, so as to make food abundant and the conditions favorable to life. In such a case the species would multiply rapidly, with little tendency to variation from the normal condition. These conditions may be such as to make food scarce, make life a struggle, and kill off the great majority of the organisms of a species. In such a case there is marked tendency to variation. Those characters or traits most useful or helpful in the struggle will be selected, and organisms differing from their ancestors in some ways will be the result.

Again: in addition to the above two cases, and modifying either, there may be the presence or absence of natural enemies, which prey upon the organisms, increasing or reducing in numbers accordingly. Where food is most abundant and enemies practically absent there is great multiplication of numbers. Illustrations of these conditions are to be seen in America in the English sparrow, the San Jose scale, the codling and gypsy moths, and other noxious insects. Where food is scarce and enemies abundant there is either great variation or extinction of species, or both. Under such circumstances the struggle is keenest and most severe, those least able to survive are killed, and the resulting and living specimens are likely to be strong and hardy, unlike their ancestors, continuing to vary in structure so long as the hard conditions exist.

Let us make application of these principles to the life as we find it in Daphnia Pond.

Vegetable Life. Trees are absent. As no trees in the region other than willow shrubs can live in water the pond must be older than any trees growing near it.

When water collects in any place it is immediately invaded by certain forms of vegetable life, water plants. In sustaining life these plants begin to fill the pond. Their roots sink into the soil to hold the plant. Their stems become so thick and matted that whatever silt is brought into the water is held, and is not permitted to run out. The pond is gradually filled in, the plants in living, slowly make living impossible, and the result is the extinction of the pond and the death of both its animal and vegetable life.

Daphnia pond admirably illustrates the method by which a pond is filled. In the center is a small space of open water, twenty feet deep. This is bordered by a fringe of yellow water lilies, whose roots are deep in the mud, and whose leaves reach up through five or six feet of water to the surface. Among these are matted masses of lower forms of vegetable life. Outside, in shallower water, the rushes and cattails hold sway, their decaying leaves and stems each year adding to the decayed vegetable material. Nearer the shore the sedges have taken hold, and formed large hummocks, sufficient to bear the weight of a man. Along shore willows have taken firm hold on the soil.

This tangled mass of hydrophytic vegetation affords abundant hiding place for various forms of animal life, and at the same time supplies food for them, as testified by their great numbers.

The glaciated ridges adjacent have in very recent years been cleared by fires. A new vegetable growth is appearing, which may change the life materially.

Animal Life. Vertebrates are scarce in the waters of Daphnia pond. Fish are absent. This goes to prove that the pond has at no time had sufficient outflow to permit the ascent of fish from Flathead lake. Certainly fish could live in the water, since it is clear and cold, and probably has underground seepage. There is a good supply of animal food. Frogs are rather abundant, as are also garter snakes. The frogs prey upon insects, the snakes upon both insects and frogs. A dark green grass snake has also been observed. A single species of turtle has been seen, but they are rare. Among the rushes a few muskrat homes have been built, but the animals are scarce and shy.

The invertebrate life is abundant in numbers of specimens, but not in species. Three species of shells are found in the water, one on land. **Planorbis trivolvis** Say and **Sphaerium partumeium** Say are abundant in the hydrophytic vegetation. **Physa ampullacea** Gld. is rather common. **Pyramidula strigosa**, var. **cooperi** W. G. B. is found in damp places on land. It seems strange that but a single land snail has been found.

Among the entomostraca **Daphnia pulex** holds sway. So abundant is the species that the water in the open space near the center is colored a dull reddish brown. They may be taken in any quantity. Forbes reports that this species is probably a fish food. This may explain its scarcity in Flathead lake as compared with Daphnia pond. Forbes reported the species as absent from Flathead lake. It has been found by us in our studies each year up to present writing. Much less abundant, but still common, is **Diaptomus lintoni** Forbes, while in still smaller numbers is found **Cyclops pulchellus** Koch. **Gammarus**, probably two species, hide among the water lilies and rushes.

Insects are abundant. It is no doubt a breeding place for mosquitoes, although no larvae have been taken. Unidentified dipterous larvae in considerable numbers have been taken. No fewer than ten species of dragonflies have been captured on the wing. Most of these have also been secured in larval stage. Other material to be found in the pond in abundance may be mentioned; many beetles, two leeches, several case worms, many water bugs, diptera, and worms.

The vicinity of this pond is a great breeding place for birds. No fewer than forty-five to fifty migrants build their nests and rear their young within a hundred yards of the water's edge. For so small a pond this is a very good showing. On all sides the timber has been destroyed by fire. Thus most of the shelter formerly afforded has been removed. The nesting sites are confined to the low bushes along the water's edge, to those which have sprung up in the burnt area, to the dead boles left by the fire, and to the grass and reeds of the pond. Rails are heard daily as they move around among the weeds. Golden-eyes and grebes usually rear their young in the grass. Catbirds, western yellowthroats, flycatchers, chickadees, sparrows, juncos and woodpeckers, all are found. The tree dwelling warblers find a few trees near by. Kingbirds may always be noticed, noisily chattering as they leave their perches in pursuit of insects. The total number of species of birds observed in the vicinity of Flathead lake as given by Silloway is 135. One-third of these may be found in the immediate neighborhood of this one small pond, showing the opportunity for study afforded by it.

Of the smaller microscopic life of the waters no examination has been made. Of protoza, diatoms, desmids, and the smaller worms there is no doubt a large number owing to the abundance of entomostracan life which the pond supports.

Owing to the size and character of the pond it offers an admirable site for detailed study of several forms of animal and vegetable life with respect to environment, with opportunities for experiments in changing the conditions, thus vitally affecting the lives of the inhabitants. In comparison with the waters of Flathead lake Daphnia pond teems with life, although but a short distance from the former, and insignificant in size in comparison. In the large lake there is little protection along the shore, owing to the pebbly nature, almost none in the bottom. The vegetation is confined to a few areas at either end where shallow water makes a swamp, and where vegetation can have a footing. The water is clear, cold and deep. Receiving a constant influx of cold water from the Swan and Flathead rivers, the lake does not cool rapidly save in the shallow bays where the water has little motion. In Daphnia pond, however, there is abundant vegetation. Great mats of it may be pulled out from almost any portion, from the growing green plants uppermost to the dead and decaying peat below. This mass is alive with living and crawling objects, which here find ample protection. There are no fish to destroy them while in the larval stage, hence they multiply rapidly. Among insects many have been mentioned. As these emerge from the water to the air they prey upon each other, and are in turn preyed upon by birds. A bittern was killed with his stomach full of the dragonfly **Aeschna constricta.** Kingbirds are known to prey upon them also. There can be little doubt but that many species of birds live principally upon the insects about the pond, although no examination of stomachs has been made other than as above mentioned.

Daphnia pond is commended to the students of the station laboratory as an excellent place for securing material for statistical studies in variation, for determining the relationships of hydrophytic and hydrozoic life, and for experiments on both forms of life. It offers to teachers an admirable place for securing material for class use, being one of the best collecting fields discovered in this section of the state.

Types of Nests of Birds.

TYPES OF NESTS OF BIRDS, WITH SPECIAL REFERENCE TO THE FLATHEAD REGION.

Perley Milton Silloway.

The nest-building habit of the birds is a marvel of inherited experience. Is it not remrakable that these feathered creatures of the air, roaming among the foliage of trees, bushes, or meadows for the greater part of the year, should settle upon a particular site, and construct a habitation that often withstands the climatic vicissitudes of many seasons? We regard the cowbird as peculiar because of its habit of stealing among the bushes and depositing its eggs in the nests of other birds; but are not the other birds even more peculiar in their instinct of suspending their Bohemian habits for a short period, and settling down to the humdrum occupation of house-building and home-keeping? When we remember that for eleven-twelfths of the year the birds have no place of shelter

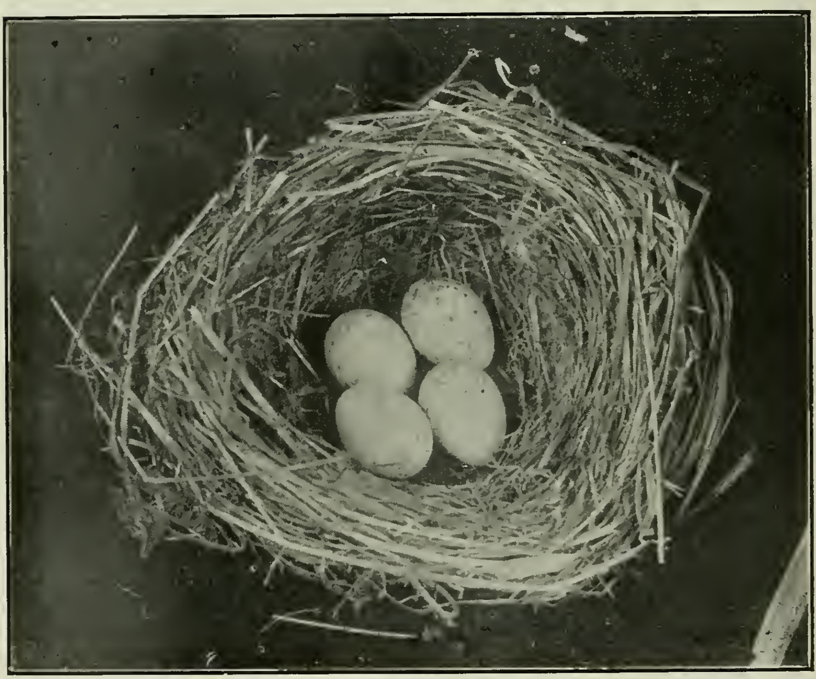


FIG. 17. Nest and Eggs of Olive-backed Thrush.

or retreat known as home, we may well wonder at the power of the impulse or instinct that leads them to build a strong dwelling for use but several weeks at most, and confine their activities to a limited range.

The knowledge of nest-building manifested by the birds is doubtless inherited. This theory is strengthened when we learn that birds of the same species construct nests of the same general type, following a common pattern of architecture and using materials of similar texture. A robin's nest in Montana differs in no essential feature of structure or material from one in Illinois or New York, and generation after generation of robins construct nests of the same typical style. If a robin be taken from the nest and reared apart from other robins, its attempts at nest-building will follow the plan approved by years of robin experience. Therefore when the bird-student becomes familiar with the type of nest constructed by any species of his avian friend, he will be able to identify the nest of that species thereafter with little difficulty.

After selecting a convenient crotch of some tree not far removed from civilization, the robin makes a substantial foundation of dried grass, strings, rags, or other similar material. Upon and within this Mrs. Robin erects a strong mud wall, smoothing it interiorly by rubbing and molding it with her breast. Then she places a bedding of coarse dried grass in the bottom of her cot, and she has a habitation as comfortable as a prairie settler's dug-out.

Among the nest-builders of the Flathead region, the olive-backed thrush is quite abundant. It selects a site near the top of a small fir tree, from six to ten feet from the ground, or in an upright crotch of a slender sapling, generally in the edge of a swamp or retired woods. The base of the nest (Fig. 17) is a loose mass of dried grass and weed-stems, upon which the builder forms a snug-walled structure of dark-green lichen and fine dried grass, the latter also serving as lining for the nest. It is said that in more northern localities a larger proportion of moss and lichen is used by this thrush, but the type of architecture is characteristic wherever the thrush is found nesting.

Belonging to the same genus as tne olive-backed is the willow thrush. It is the rule that birds of the same genus have similar habits of nidification, but the willow thrush differs very materially from its congener in its plan of architecture. It uses very coarse weed-stems and strips of bark, pine needles, and dried leaves, all dark material, making a thick-walled cup generally deeper than the work of the olive-backed, lining it with dark root-fibers. This nest is generally placed on or near the ground, frequently on a heap of decaying leaves or similar rubbish. In 1902, however, a nest of this thrush was found six feet from the ground, in an upright crotch of an oblique sapling, a very unusual situation for the nest of the willow thrush.

The catbird is one of the common birds of this portion of the Flathead region. Its nest is made in a low bush, usually among upright stems. It is a bulky structure, also made of dark material. Like the willow thrush, the catbird uses strips of coarse bark, weaving them into a strong basket, which it lines with coarse rootlets. Pieces of dried leaves, and fragments of twigs are also used in the framework of the catbird's nest. In appearance this nest closely resembles that of the willow thrush, though the different site in each case renders identification quite easy.

A type of nest radically different from any of the foregoing is presented by the American dipper, a bird which haunts the rapids of our mountain brooks, and plays in the splashing waters as they foam among the rocks or dash down the rock declevities. The nest of the dipper is a hollow ball of green moss, oftenest situated where it is kept soft and moist by the spray of rapids or falls, on a shelf of rock, or among the roots of trees washed by the brawling stream. On one side of this mossy, dome-shaped habitation is a circular entrance, and within it is an inner nest of leaves and grass. The site is nearly always among mossy surroundings, and the nest is easily overlooked by anyone not familiar with the nesting habits of the dipper.

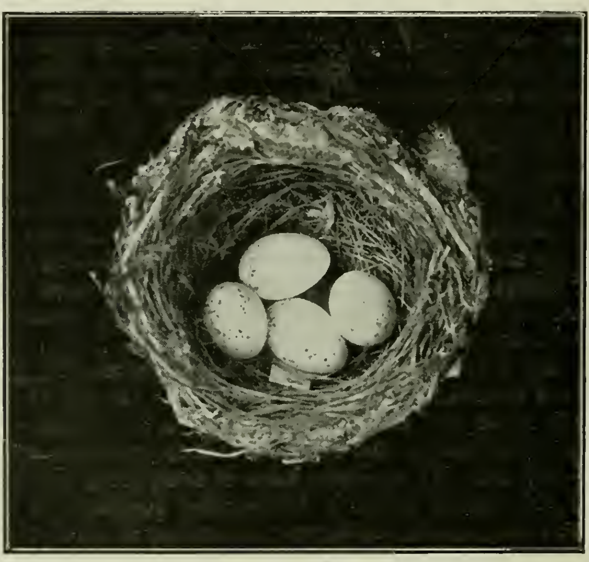


FIG. 18. Nest and Eggs of American Redstart *Setophaga ruticilla L.*

Among the warblers of this region, the American redstart is a nest-builder of some note. It chooses dark gray-colored material (Fig. 18), such as fine strips of inner bark-fibers of weed-stems, bits of dark green lichen, flakes of gossamer, and fibrous grasses. These it shapes into a neat, well-rounded cup, fitted into some crotch formed by a small twig and a larger branch, generally upright, from six to twenty feet from the ground. In size the nest is probably the smallest among the warblers, and is difficult to detect in the gloomy light of the swamp-woods, as it resembles an enlargement at a joint of the branch.

The ground-dwelling warblers of this region manifest a great similarity of taste in their style of architecture. In this group are the western yellow-throat and Macgillivray's warbler, both of which make their nests in grass tufts, about eight inches from the ground. The structure is made exteriorly of long pieces of grass stems, interiorly of fine dried grass, rootlets and horsehair. When made in a grass tuft among rank sprouts and small bushes, the nest of Macgillivray's warbler cannot be distinguished from that of the yellowthroat in similar situations. However, the yellowthroat chooses other sites, notably the rushes of ponds and swamps. In such situations the nest material is likely to be taken from that nearest at hand. A nest of the yellowthroat taken from Daphnia pond was made altogether of pieces of dried flag, with a lining of fine grass, thus resembling a cup-shaped basket of irregular weaving.

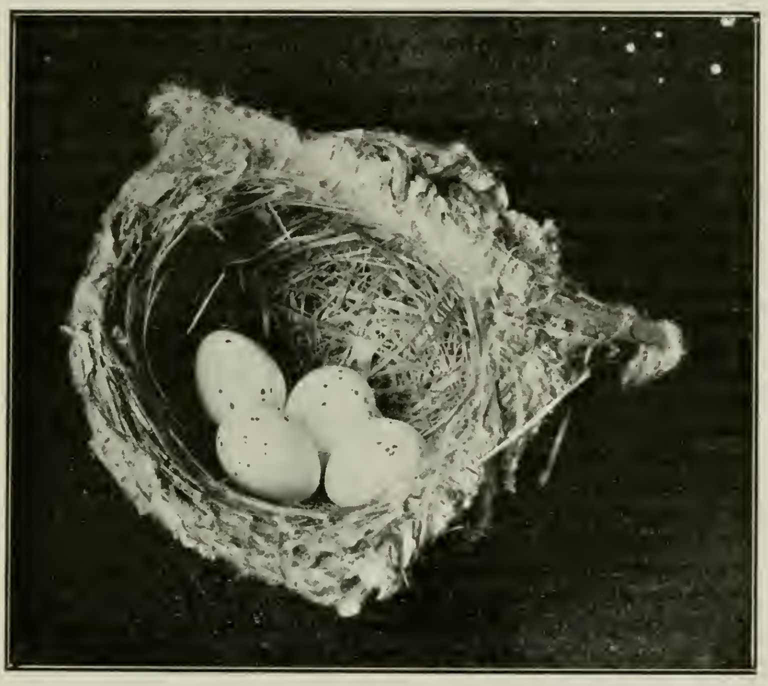


FIG. 19. Nest and Eggs of Warbling Vireo, *Vireo gilvus* Vieill. Photo by M. J. E

Though scarcely constituting a type, the nest of Audubon's warbler is somewhat different from other nests which it resembles. It is rather larger than that of the yellow warbler, and darker in appearance, assimilating more closely with its surroundings. Its outer appearance is much like that of the redstart, though it is so much larger that there is no likelihood of confounding the two. This nest is made of dark weed-stems, strips of weed-bark, gossamer, and fine dried grasses, with soft feathers and horsehair as lining material. The use of feathers in the inner wall serves to distinguish this nest from the work of the yellow warbler.

For neatness of structure and harmony of appearance, the nest of the yellow warbler is a noteworthy example. It is usually made in an upright crotch of small branches, from five to fifteen feet from the ground. The materials chosen are of a grayinsh color. The predominating substance is fine dried grass, woven together with downy fibers, shreds of weed-bark, fragments of gossamer, and horsehair. The peculiar feature of this nest is the neatness of the interior finish. Frequently one is found that is lined throughout with white vegetable material as smoothly as if satin or morocco were used.

As a distinct type, the nest (Fig. 19), of the vireos is interesting in several ways. The site is unique, being invarably a horizontal or drooping fork of twigs near the extremity of a branch, from six to twenty feet from the ground. It is a swinging cradle firmly attached by its brim, without motion in itself yet swaying with every impulse of the passing breeze. The outer wall of the nest is very loosely arranged in an irregular covering of fibrous shavings, strippings of bark, gossamer, and pieces of hornet paper. The bedding of the nest is fine dried grass of a wiry texture. The foregoing descripton is alike applicable to the nests of the red-eyed and warbling viero, the only representatives of the vieros in the Flathead region. The external materials of the nest of the red-eyed vireo is generally more loosely disposed, the cavity is somewhat larger, and the structure as a whole averages larger than the nest of the warbling vireo, otherwise no difference is observable.

In this locality the cedar wax-wing constructs a nest (Fig. 20), of an interesting type. It is generally placed near the top of a small evergreen tree, or near the extremity of a horizontal low branch of a larger evergreen. The foundation of the structure is a loose mass of dried grass and small twigs. The walls are made almost wholly of dark green lichen, pinned firmly together with pine needles and smaller twigs. Frequently the nest has a lining of fine wiry grass. This type of nest is characteristic of the cedar wax-wing in the northern evergreen forests.

One of the most abundant birds of this region is the lazuli bunting, the western representative of the familiar indigo bunting of eastern habitat. The nest of this bunting is made in low bushes, from two to five feet from the ground. It is a type in its simplicity, being made of coarse dried grass and weed fibres, lined with fine grasses and horsehair, the main elements being of a grayish white color. The walls are loosely woven, and the nest is rather large for the size of the owner.

The nest of the black-headed grosbeak is a type because of its loose arrangement and frail structure. The ordinary site is the top of a large, loosely-spreading bush, a small evergreen tree, or the top of a low thorn tree. In such situations the eggs can generally be seen from below, as the nest materials are so loosely woven that the bottom is comparable to a net of several folds to retain the eggs. The affair is made of dark-colored twigs and rootlets, and is usually lined with finer rootlets of a darker color, or with fine grasses of similar hue. Last season a nest of grosbeak was found lined with fine moss-stems of a reddish brown color, the effect being a very handsome nest. The nest is so frail that the materials readily fall apart, or the twigs drop away one by one.

The familiar chipping sparrow constructs a nest of simple yet original pattern. An outer wall of finer weed-stems, grasses, or lichens, and an inner layer of horsehair, are the essential features in the chippy's idea of building at all times and places. The outer layer is variable or may be lacking, but the horsehair is indispensable, and frequently the nest contains only this material. The chipping sparrow's habit of using horsehair has suggested its nikname of hairbird in many localities. Generally dark or black hair is used, but this season I found a nest in which white or gray hair was used, the only nest of the chipping sparrow thus finished that I remember to have seen.

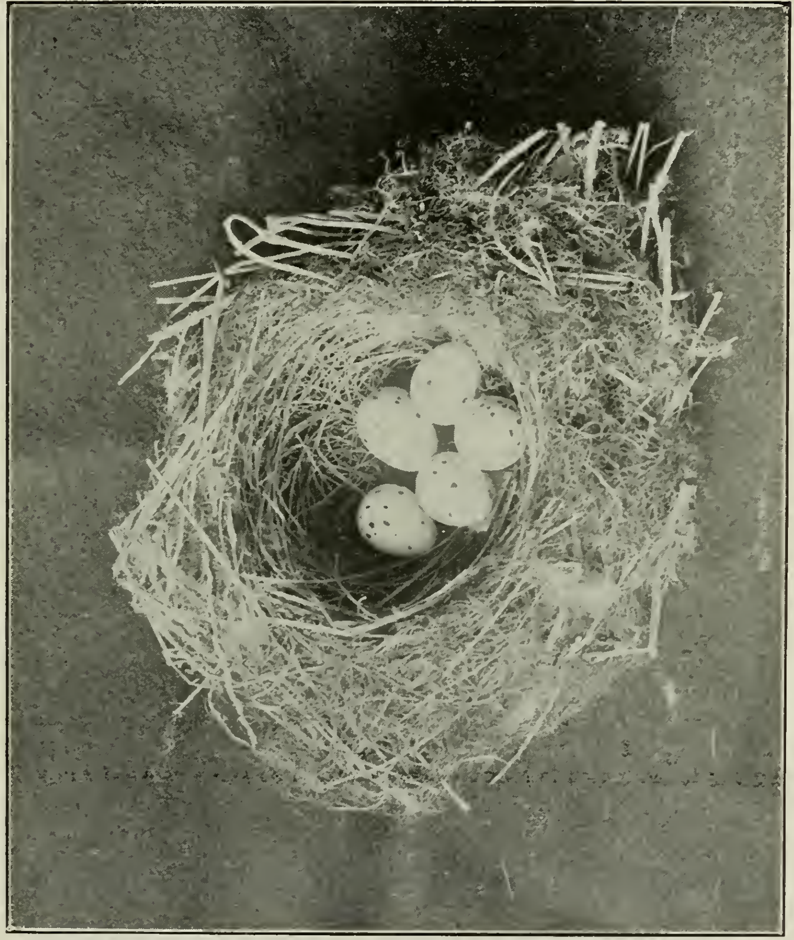


FIG. 20. Nest and Eggs of Cedar Waxwing, *Ampelis cedrorum* Vieill. Photo by M. J. E.

Another sparrow of this region, the western vesper, follows a plan of building similar to that of the chippy. The site is a depression in the ground, at the base of a tuft or small bush. There is generally an outer wall of dried grass or weed-stems, and a lining of horsehair. In many nests, however, the horsehair is lacking, fine dried grass being substituted for it, hence we see that the type is not so constant as that of the chippng sparrow. Moreover, the nest of the vesper sparrow is a very flimsy affair, held in shape chiefly by the cavity it occupies, and not likely to retain its form when removed from the site.

The nest of the black-headed jay is seen frequently in this region, along the mountain streams and lake shores. This nest is oftenest made in small firs, on horizontal branches against the main stem, from six to eighteen feet from the ground. A typical nest consists of an outer framework of coarse dried twigs, interlaid rather loosely. Within these is a layer made of coarse weed-stems and muddy moss or lichen. Internally there is a layer of coarse brown rootlets. One of these nests is about eight inches across at its top, and five inches high.

The nest of the American magpie is a peculiar structure, though interiorly it is very similar to that of its relative just noticed, the black-headed jay. The base is a mass of large twigs, which supports a basin of dried clayey mud from seven to ten inches in diameter and about six inches deep. Within this earthen bowl is an inner nest of coarse brown rootlets, frequently with a scanty amount of horsehair. Over the nest, at a height of a foot or more, is a thick canopy of dried sticks, forming a snow-proof covering. Around the sides is a lattice-work of stout twigs, frequently so closely interwoven that a regular opening is necessary for the the entrance and egress of the owners. Commonly, however, the birds enter through openings due to the loose degree of interweaving of the materials.

Among the nest-builders of this region, Wright's flycatcher next demands consideration. A typical nest is very similar to one of the yellow warbler, both in situation and construction. It is made of grayish fibers of weed-stems, shreds of bark, and gossamer, within which are woven small downy feathers and cottony materials, besides which a few fine grasses are frequently used as lining. The tiny feathers used in this nest aid in distinguishing it from the yellow warbler's, though sometimes a nest is found which is felted as softly within as some nests of the yellow warbler. See Fig. 21.

The woodpeckers, of course, nest in cavities which they make in the trunks of trees, at varying heights from the ground, and deposit their crystal white eggs on the bare floor of the cavity, making no attempt to carry material to complete the interior.

Most of the hawks and owls of this region seldom go to the trouble to construct a new nest, but usually take possession of an old structure made by some more industrious builder in a former season. The spirited little sharp-shinned hawk, however, makes a new nest each year, its habitation being quite typical. The site is low, two that I have examined in this region being each within eight and nine feet from the ground. The nest is a mass of twigs, having a very slight depression and no lining material to receive the handsome eggs which this hawk produces.

Among the water-birds of this region, the most characteristic nests are those of the grebes. These nests are made in the swamps, among dead and growing reeds, in water a foot or more in depth. The nest is a mass of black, decayng material, intermingled with which is some green material of the season. This mass of rubbish is anchored among the reeds, generally forming a low mound projecting about four inches above the water, and measuring from eighteen to twenty-four inches across at the surface of the water. The cavity is very slight, and generally contains a lot of loose stringy material like that in the nest, which can be hastily scratched over the eggs to conceal them when the owner leaves them.

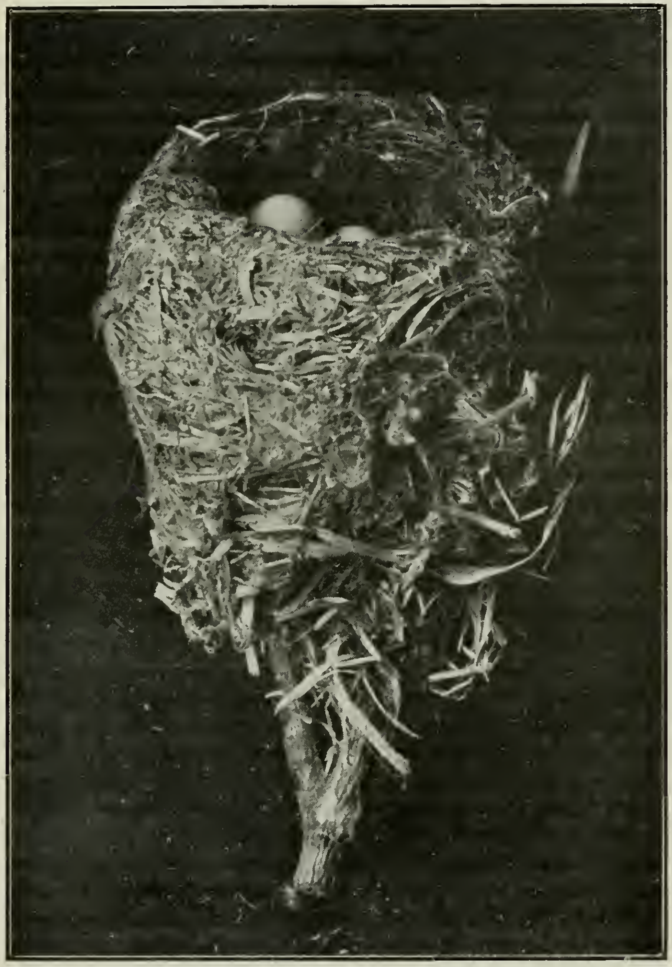


FIG. 21. Nest and Eggs of Wright's Flycatcher, *Empidonax wrightii.* Photo by M. J. E.

Animal Counterfeits.

Maurice Ricker.

I have previously told of the marvelous adaptations of plants and animals. We have been duly impressed with the perfect harmony of adjustment and are prepored to examine into the more intricate relations existing between them. Let us keep in mind the universal struggle for food, the great loss of life in immature stages, and the tendency to variation. We believe that whatever variation tends to perpetuate the life of an individual, or to render it less liable to annoyance in procuring food, will prove of advantage to the race, since this variation tends to be transmitted to the offspring.

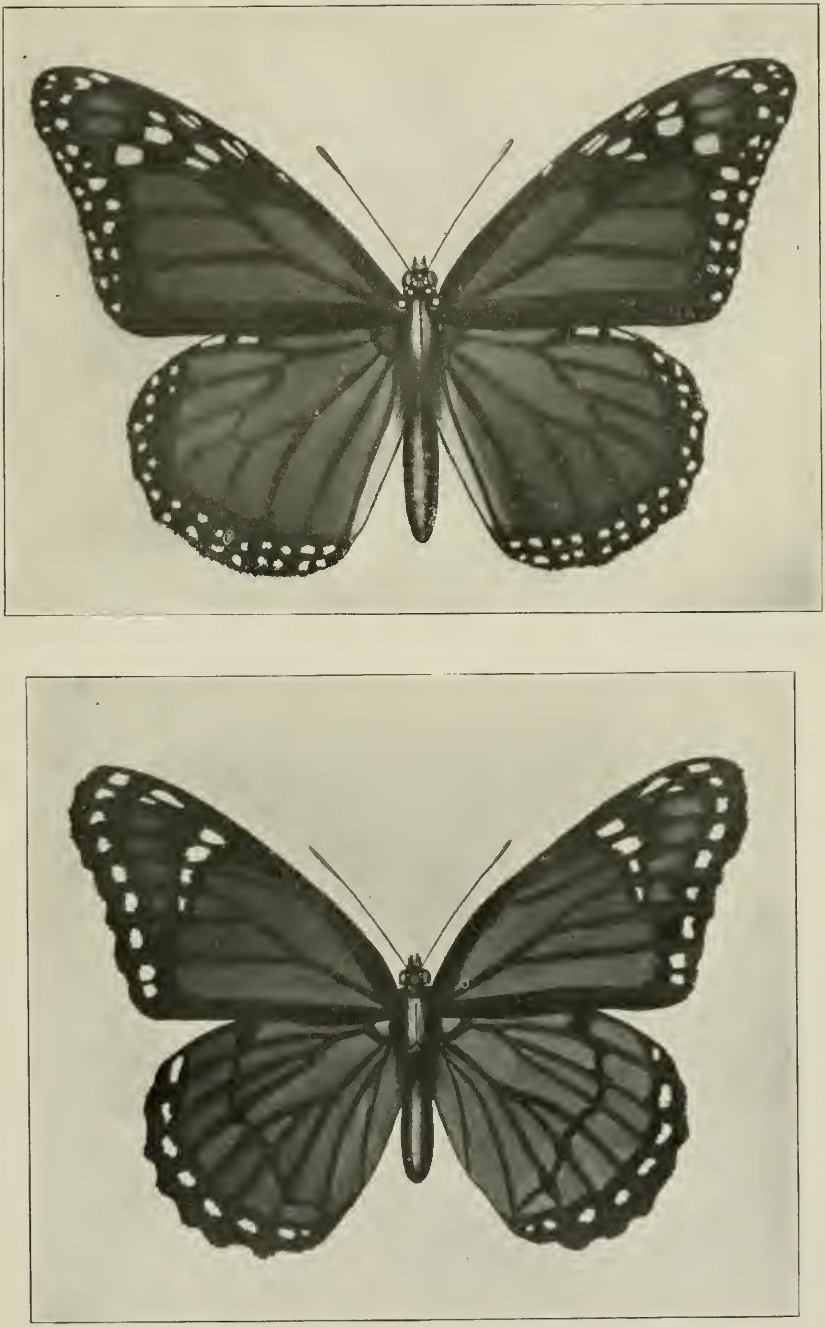
Truly, might an animal exclaim, "This is a world of shams." "Everyone is seeking to deceive." Aesop's fable of the "Ass in the Lion's Skin," is a tame story compared with the one we may see in nature any summer afternoon. For, in the fable, the ass masqueraded but for a day while in nature we find animals whose ancestors, for a thousand generations, have carried out their hypocrisy for a life time.

The simplest example, and one which every one has observed a great many times, is called protective coloration. Upon the success with which an animal can become apparently a part of the general landscape depends his very existence. The lessons we have all had when seeking some wild animal have fixed this principle well in our minds.

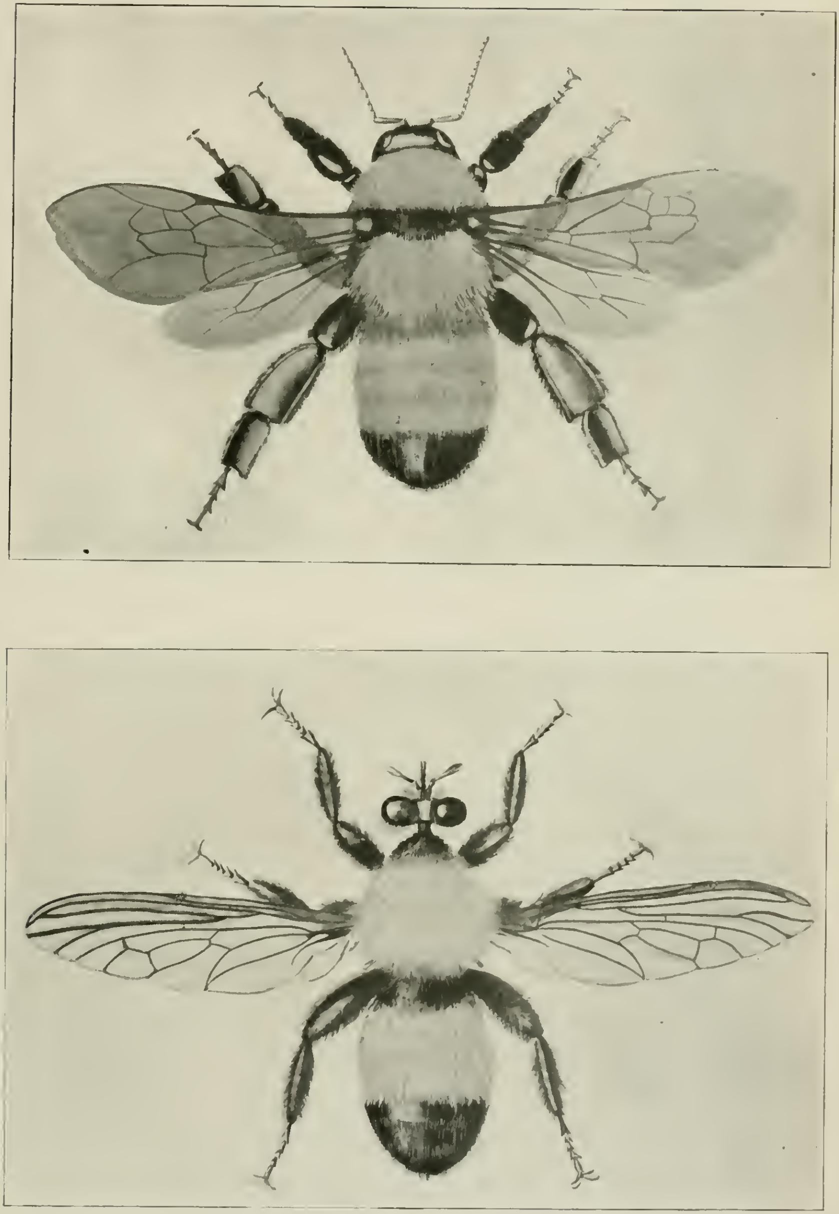
I remember once seeing a young spotted sandpiper on a rocky sandbar in a small stream. I went over to pick him up, when, as if by magic, he disappeared. In vain did I search and, for all I know, the little rascal is hiding there yet. He was no doubt sitting motionless among the rocks, and my eye was not keen enough to discern him among the light and shade of the pebbles. If animals are not wholly devoid of humor, what a good joke it must be—this game of hide and seek of theirs.

But it is serious business. It is in reality a game with the player's life at stake. If he wins he lives to perfect his art and practice his profession of a counterfeiter. If he lacks confidence in his own game and betrays by a move the fact that he is not a part of the inanimate landscape, he pays the penalty with his life. If through variation he happens to be more conspicuous than his type he stands a much greater chance of being picked up by his enemies. Thus nature would check a tendency to more conspicuous colors.

A few words on color in general may not be out of place. Scientists now find significance in nearly all coloration. At one time it would have been sacriligious to have found other reasons for nature as it is, than as a creation solely and wholly for man's pleasure. I, for one, do not believe that man's reverence for nature or nature's God is any the less deep, for what may be called a more modern view. The true dignity of man and his exalted place in the universe is not lowered by this conception



Mimicry of Anosia plexippus (upper) by Basilarchia disippus (lower). Photos from water color drawings by Mrs. Edith Ricker.



Bumble bee (above) mimicked by fly (below). Photos from water color drawings by Mrs. Edith Ricker.

of the organic world. A hundred years ago they said the hills are clothed in green and the valley bedecked with flowers solely to please man's eye for color. The poet says that "Full many a rose is born to blush unseen, and waste its sweetness on the desert air." I take it that the relations of plant and insect life thousands of years before man's appearance on the globe were much the same as to-day, and that an intelligent understanding of these facts will add largely to man's enjoyment of nature. Is not the pleasure of intellectual insight into nature of even higher order than the gratification of the sense of sight and smell." So color must be studied with the good of the race always in view.

In general animals wear colors that harmonize well with their surroundings. This arrangement may serve one of two important purposes and sometimes both. The most obvious use is that of the case just cited, where concealment is most desirable and necessary for protection of the animal sought by stronger animals for food. The other case is easily explained in the case of the polar bear. He has no enemy but hunger and his coloraton enables him to steal upon his prey unobserved.

The advantages of protective coloration are still more clearly brought out by the examples of those animals which change their color with change of season. The Rocky Mountain goats live always on or near the snow. They remain white throughout the seasons but the ptarmigan changes to match the ground in summer and the snows in winter. The weasel and many other animals change their coat with the seasons.

We find in insects some of the most marvelous instances of coloration. It is well known that green larvae usually feed upon green leaves and brown larvae rest upon brown stems. The cocons of moths are sometimes wrapped in leaves and the naked crysalids of various butterflies resemble dried leaves. The common walking stick, as it is well called, while a common insect of the field is seldom seen owing to its almost perfect resemblance to the twigs upon which it rests. The measuring worms, as they are called, more properly the larvae of grometrid moths, have not only the color of the plant upon which they rest, but when disturbed they hold to the stem with their abdominal feet, and, stiffening themselves at an appropriate angle to the stem, look precisely like the petiole of a leaf or a broken branch. It is a truly interesting experiment to tap a plant upon which they are feeding and note how rigid they become and how perfectly they assume the proper attitude. After a few minutes they will slowly unbend and become living larvae once more. Who has not walked through a forest and seen the brilliantly colored catocala moth flit an instant before his face and apparently disappear when he alights upon the tree trunk? As interesting a disappearance is that of the coralwing locust who flies with a gaudy flash of red or yellow and drops into the dust in the road to all appearances as lifeless as the clods around him. It is often necessary to scare him up many times before you are able to detect the dust colored form crouching in the dust, ready for a spring. So we might continue to name hundreds of familiar cases of protective coloration among animals. Besides, especially those birds which nest on the ground are protectively colored. We have all experienced the thrill of seeing a nighthawk get up from under our feet. You may have searched the ground in vain for the speckled eggs laid so openly on some bare rock with the same lack of success that I have had.

I want here to mention some points not always understood. It is not supposed that the lower animals use cunning in their counterfeiting. We consider rather that they are unaware of the part they play. They certainly have no intent to deceive and are many times not conscious that they have any advantages in concealment. The chameleon changes color to suit the color of the substance it nests upon as nearly as possible, without conscious effort. By destroying his brain with a wire and then placing him on the colored backgrounds, this has been proven to be a reflex action.

The young robin instinctively remains in the posture I place him in, no matter how uncomfortable it may be. The nighthawk flops around and leads us away from her nest with no more thought than when she formed the blotched eggs which are so difficult to see on the ground. This leads up to a consideration of instinct and animal intelligence which must be deferred to another time.

Under the head of protective coloration are the many instances of warning coloration. Here the animal seems made for show and certainly intends to be seen. His colors stand out brilliantly; and as fitting actions accompany coloration we notice in this class of animals a disdain of concealment and often, in the case of flying insects, a loud buzzing noise. The bumble bee goes about its business and makes all the noise it pleases; in fact, seems to announce its coming.

As an example of warning coloration notice the orange or yellow banded bumble bees. If you are in doubt as to whether they need to conceal themselves catch one of them in your fingers and learn wisdom. If you need further experimentation next try the orange banded hornet. It may be difficult to teach one who has tried these experiments that these animals are well behaved, peace loving citizens of the insect world. If you stop to reason you will perceive that you were the aggressor in this instance and that you have hitherto carefully avoided thousands of these yellow or orange banded insects flying around with a buzzing noise. These insects are not armed with the intention that they are to use their weapons frequently. The occasional one who is imposed upon teaches the rest of the animal world to leave all similarly uniformed insects alone and as a rule they go on their way unmolested and to these colors owe their freedom from annoyance. Other insects like the brilliantly colored beetles and the Anosia butterflies are very distasteful to birds and their other enemies. Unless a bird inherits a suspicion against them he will soon get a bad taste in his mouth that will remind him for all time of its source. Certain caterpillars are likewise protected. Our common potato bug has few enemies after it hatches into the larva stage. If it were so fortunate with respect to its eggs it would no doubt exterminate the potato plant.

A very strangely marked blue frog of the tropics was placed before a number of cautious fowls. After a time an unsuspecting gosling took
a number of cautious fowls. After a time an unsuspecting gosling took
for some time shaking its head and evidently very sorry for its error.

Among mammals the skunk is a strikingly colored as well as a strongly scented animal. But why tell of warning coloration in a study of counterfeit? You say surely the bees are an honest self respecting folk. So they are, but we must understand what freedom from annoyance or extermination they enjoy and then we are fully prepared to comprehend the beautiful scheme by which nature protects her own from her own. Let us look for a moment at the **Anosia plexippus** (Plate L.) a butterfly of tropical origin, which migrates northward in the spring time, lays eggs for a spring brood which complete the cycle and migrate further northward. The fall brood migrate southward in September. There is no easier butterfly to raise from the egg which may be found on the common milkweeds. Why does this butterfly enjoy such a freedom of flight? It is found upon trial that birds forcibly fed upon the adult **Anosia** become very sick. It would seem that the birds have either tried the experiment or are warned in some way from doing so. They therefore never touch brown butterflies of this size with a black bordered wing bearing a row of white spots.

Let us now look at representative members of a widely separated genus, the **Basilarchias** (Plate L.) We find them to be generally purple in color with white or brownish markings. The common species of this genus in Montana has a broad white band on the forewings. In habit they are shy and flit from one bush to another.

One species of this genus differs radically from the others in coloring and habit. It is the species **disippus**. It is almost a perfect copy of the **Anosia** just described. It also has the habits of that insect. The early entomologists, who made the classification a matter largely of external appearance, very naturally classified the two together. In fact they are so nearly alike that they deceive everyone but the trained entomologist who looks beneath outward appearances. They differ in that the **Basilarchias** are edible when birds can be induced to try to eat them. This is doubtless a very rare occurence in nature owing to the perfect resemblance to the undesirable species.

Wallace states the conditions necessary in order to effect mimicry are follows:

1. The two species, the imitating and imitated, must occur in the same locality.
2. The imitating species must be the more defenseless.
3. The imitating species must be the less numerous.
4. The imitating species must differ from its allies.
5. The imitation is external only, affecting only external appearances.

As to the origin of such a species some think that it must have come from **Basilarchia astyanax**, the common species of the middle states, which is sprinkled with brown spots. It may be that certain individuals differed from the current stock in being nearly or entirely brown. A sudden variation to a widely different type is called a sport and occurs in all species. If the sport came near enough the **Anosia** in color to be mistaken by its enemies for an edible species, it would be likely to live to reproduce. From the eggs of such an insect perhaps only a few would resemble the parent but these few would stand the better chance of living and eventually would become distinct, owing their very existence to an accidental similarity of sports. Each generation tends to make the resemblance greater as the unprotected ones would be more likely to be eaten by hungry birds. We therefore call this a case of insect protective mimicry. It is probably the best case known. The manner in which the species arose teaches Darwin's great doctrine of the survival of the fittest and explains what he means by natural selection. Without this great key to the secrets of nature before the time of Darwin man was unable to explain many great biological problems, as for example the existence of related species and the enormous waste of life in arriving at maturity. The law of survival of the fittest solves to the satisfaction of many these great problems. The animal takes no conscious part in the great scheme of nature. It takes no thought as to how it is clothed or fed. The unalterable laws of the universe are at work upon it, but it need not know or care.

Another line of counterfeiters of very great interest are the numerous unarmed insects who wear the uniforms of the wasps or bees. We need not go into the subject very deeply since it is almost a parallel case to the one given at length above. It is of obvious benefit to a defenseless fly to wear the yellow sash of a bee and thereby escape attacks of enemies which fear the sting of the bee. Many such can be found on the flowers almost any sunshiny day in summer. There is a family of flies that especially enjoys this disguise and feeds on the nectar of flowers, sucking through their long slender probosces. Since they aid in cross-fertilization as much as would a true bee I do not know that we should condemn their deception too severely. We may look upon them as harmless masqueraders.

While we admire the cunning in nature which protects so many helpless and innocent ones from injury, what shall we say of those rascals who wear the uniform of the bee, not for protection to themselves, but for the purpose of being better able to steal upon their victims. Many a tragedy in insect life occurs in about this way. A strong two-winged fly looking very much like a bumble bee in size and color and differing slightly in the buzz of his wings alights on a clover blossom and settles down to await a victim. Soon a heavily laden bumble bee alights upon a neighboring clover head wholly unsuspecting the counterfeit bee on the other blossom. Like most honest people he has little time to harbor suspicion of evil from one of his own kind. The villain squares himself for a jump through the air. A second later he alights upon the back of his victim. He holds the dangerous abdomen with its deadly sting securely in his bristling legs, and punctures with his strong beak the shiny armor on the bees thorax. In a minute it is all over, and, dropping the lifeless victim, he begins to clean himself after the manner of the fly family. I have his picture for the rogue's gallery. (Plate LI.) See how much like a bee he is even with wings and legs spread to show the differences. Gibson has told the Syrphus fly story especially well in his "Sharp Eyes." There is a large number of the robber flies who mimmic for aggressive purposes.

Why are all small boys afraid of a dragonfly? The boy believes the real mission of the dragonfly in life is to feed snakes and sew up the eyes, ears or mouths of small boys? Catch a dragonfly or a cranefly or any other insect with a long abdomen and how does he act? It turns the abdomen around wasp like and pretends it will sting. The boy believes the dragonfly will sting. Later in life he learns that the insect is perfectly harmless.

Among caterpillars there are many amusing instances of larvae being provided with means of putting on a horrid face or swelling up in such a way as to strike terror to the heart of all but those who know his ways. Snakes coil as if to strike, dart out their little forked tongues and look very vicious. Butterflies have big eyes on their wings giving them the appearance of larger and more ferocious animals. There are thousand of instances in which the animal, while perfectly harmless, deceives the uninitiated into believing him a very ferocious beast.

I sometimes think of the swagger and bluff of the biped coward who assumes the role of "a bad man." He may be pretending to be just spoiling for a fight. The fact is wild animals put up what we call a bluff. Some will fight a wicked battle when opportunity offers, but in general they want to be let alone. The rattlesnake sounds his warning. His rattle serves to protect him by frightening away more enemies than he fights. The armed bees carry warning colors and wish to be let alone. The mosquito seems an exception to this rule, but only the female, seeking nourishment for her brood that is to be, bothers man. Another series of counterfeiters that I must expose are those who by some display simulate the food of animals and the victim discovers his mistake just in time to be himself eaten. The kinglets and fly-catchers among birds as well as certain fish display traps of this kind. The term alluring coloration is appropriately applied to this class.

The fish bury themselves in the mud and by moving certain appendages lure smaller fish to believe that there are edible worms to be had in that vicinity. Upon attempting to obtain them they are themselves eaten.

The crowned kinglets and the tyrant fly-catcher spread a crest of orange or ruby feathers in a way that attracts flying insects to the supposed flowers. I have observed the ruby crowned kinglet engaged in attracting insects by this device. It seems to work well in early spring when both flowers and insects are scarce.

I have purposely reserved to the last an illustration in protective coloration that excells them all in the wonderful detail with which it is worked out.

Sir Alfred Russell Wallace, the naturalist who shares with Darwin the honor of discovering the theory of natural selection, on a visit to Borneo was told of two strange butterflies. One grew on trees and could be occasionally found apparently attached to the limb. The other was a brilliant blue and orange insect that totally disappeared when it flew into the shade of a tree. As you have already discerned, Wallace soon found them to be the same form and he gave to the world the example of the Kalima butterfly.

Words can not adequately describe this marvel which must be seen in its natural size and color to be appreciated. The wings fold in such a way that the tips of the hind wings touch the twig, giving it the appearance of an attached petiole. The outer border resembles that of a torn leaf. Running up the middle of the folded wings is a dark line which represents perfectly a midrib. It has a raised appearance given by an artistic rendering of light and shade effects. One can scarcely believe that it is an effect produced by flat scales.

Still more wonderful is the way in which the venation of the leaf is brought out. The natural color of the veins is heightened in the two quarters where wing veins would harmonize with leaf veins. Still more wonderful is the almost total suppression of the wing veins in the other two quarters where wing veins would run across leaf veins; but in their place, to carry out the deception, it would seem, to the minutest detail, a series of shadowy scales take the direction of leaf veins. Thus the pattern of leaf venation is completely represented. The leaf insects, leaf carrying ants, and all the long list of nature's deceivers, must yield the palm to the magnificent Kalima butterfly, the prince of counterfeiters of the animal world.

Thus nature strives to protect her own. The key that unlocks many a mystery in animal adaptation is not always easily found. Working upon the hypothesis that animals have come to their present forms and colors through adaptation to their environment we believe that there is sufficient reason for all phenomena. We have the privilege here of working in nature's own laboratory where as yet the hand of man has hardly disturbed the balance which has been brought about by years unnumbered. A few years more and where can we find a spot on this hemisphere where man has not turned the plant and animal world topsytruvy by destruction of native species and the introduction of foreign ones. Let us then improve our opportunity.

The Forest and the Prairie.

Harry Nichols Whitford.

Plants may be divided into two groups, herbaceous and woody. In the former the part above ground dies in the unfavorable season; in the latter the part above ground does not die annually. These two general forms may be subdivided. For example, the herbs may be divided into annuals and perennials, and the woody type may have the form of the shrub, vine, or tree. The climate of the greater part of the state of Montana is more favorable to herbaceous than to arboreous plants. The portion of the state east of the Rocky mountains is primarily a region where the moisture conditions will not permit trees to grow. However, there are certain parts in which the rainfall is sufficient in quantity to favor the growth of trees. The northwestern portion of the state, embracing the Flathead valley and the mountains on each side, is an extremely favorable place for the production of forests, but parts even of the Flathead valley are incapable of supporting trees. On one side of the valley, the prairie side, the rainfall is less than sixteen inches. The forest side has a rainfall of about twenty-one inches.

In order to understand why trees are confined to certain regions, it is of extreme importance to know what functions they perform and how the conditions in which they grow affect the work they do.

The tree absorbs water. It does this through its root system, and the greater the root system, the greater the power of absorbing water. The tree with an extensive and deep root system can live in drier situations, other things being equal, than the tree with a shallow root system, for its roots come into contact with more water in the soil, and in some cases may reach to the underground water level. In the latter case it is not so dependent on the amount of rainfall. Where the underground water level is near the surface, trees with shallow roots have as good a chance to get water as trees with deep roots. To illustrate these two points, compare the **bull pine** and the **silver pine.** The former has a deep and wide spreading root system. It can grow in much drier soils than the latter, which, on the other hand, has a shallow root system. It is, as a rule, confined to those situations where there is a great deal of water in the soil. Again, the root system of a tree serves to hold it in place. Those trees with deep root systems cannot be blown over so easily as those trees with shallow root systems. In the Flathead valley it is not an uncommon thing to find silver pines lying prostrate with almost their entire root system exposed, while other trees in the same situation are able to resist the wind because they have deeper root systems.

The tree is using water continually for three purposes:

1. Small quantities are used to supply the new growth that is added to the tree annually.

2. Small quantities are used in the manufacture of foods, such as starch, sugar, and other carbohydrates.

3. Large quantities are used to supply the loss by evaporation that is continually going on.

Analysis of the last process will show what role it plays in the distribution of trees.

The evaporation of water from plants is known as transpiration. The water taken in through the roots is carried through the stem to the leaves and other superficial parts of the plant, whence it passes into the atmosphere as vapor just as water in any moist object may. Other things being equal, the greater the surface a plant exposes to the atmosphere, the greater the amount of water given off. The tree, because it has a greater surface exposed than other forms of vegetation will give off more water. A birch tree with about 200,000 leaves has been estimated to give off from 350 to 470 pints of water on a single hot day. The amount of transpiration is regulated in a great measure by the conditions of the atmosphere. If the atmosphere is damp there is less transpiration than when the atmosphere is dry. Again, on a windy day the tree will give off more water than on a still day. Other things being equal, more water will be transpired on a warm day than on a cold day. Indeed, any condition that will affect the evaporation from wet objects, like clothes on a line, will affect the transpiration of a tree. In the growing season a tree like the birch will give off more water than a pine or fir tree of equal size, for the birch exposes to the air more leaf surface than the pine or fir; also its leaves are more delicate in structure than their hard needle-like leaves. Therefore the pine, other things being equal, can live in situations, which are drier during the summer months than can the birch. However, during the winter season the birch having shed its leaves exposes nothing but bare limbs to the atmosphere, so transpiration is much reduced. On the other hand the pine holds its leaves and has as much surface exposed during the winter as during the summer, and it is therefore in more danger then of losing water than a tree without any leaves. For even though the loss be checked by cold weather, absorption is checked also, because the colder the ground, the less the absorption; and if the ground be frozen around the roots, little or no water can pass into the tree.

It will be seen from the above that there is a relation between the intake and the outgo of water from the tree. If the tree is to survive, absorption must be greater than transpiration. As soon as it is equal to or less than the transpiration, the tree is in danger of drying out. In those climates where the rainfall is not sufficient to keep the soil wet enough to maintain this inequality between absorption and transpiration. trees cannot exist. But even in prairie regons there are places where there is sufficient water in the soil, as is the case near bodies of water where the underground water level is near the surface. This, no doubt, accounts for the presence of trees along streams in climates where the rainfall alone is insufficient to maintain trees.

Trees, being green plants, manufacture starch, sugar, and other carbohydrates. They do this in all green parts and therefore mostly in the leaves. Water taken in through the roots is united with carbon dioxid absorbed from the air through the leaves. In the presence of light, by an unknown chemical process, the carbon dioxid and water are changed to a carbohydrate and oxygen is given off. Of course, light reaches the trees only in the day time. This process needs a certain amount of heat, but small quantities of starch can be produced by trees with evergreen leaves even at temperatures slightly below freezing. There are probably many warm days during the non-growing season when considerable quantities of carbohydrates like starch and sguar can be made. Especially would this be true in the early spring and late fall. The trees with broad leaves can manufacture more food during the summer months than trees with needle leaves, for they have more surface exposed to light, and the greater the green surface, other things being equal, the greater the amount of food that can be formed. But the time for the making of food by these broad leaved plants is practically limited to the time of the year during which they have their leaves. As soon as the leaves are shed little or no food can be produced. Thus, while they have an advantage over the evergreen trees during the summer, the latter, because they can work more or less during the whole year, may manufacture more food in a year than the former. This is more likely to be the case in high latitudes where the temperature of the summer months is comparatively low, than in more southerly climates. Especially is it the case in climates with a more equable distribution of the heat throughout the year, the summer months having a comparatively low mean and the winter months a comparatively high mean. Such is the climate in the Puget Sound regon, where conifers are developed best in America. In the Flathead valley the distribution of the temperature throughout the year is not so equable as it is in the Puget Sound region, but it is more so than in a similar latitude in the eastern part of the United States. The evergreen trees reach a more luxuriant development in this valley than anywhere in the east, but of course are not so luxuriant as in the Puget Sound region.

The greatest danger that trees have to meet is an excessive loss of water. They are excluded from those climates that have little rain fall. A prairie vegetation can exist in these places because the plants growing here have met the danger of drought better than trees. There may be climates where the rainfall is so little that even prairie plants cannot thrive; then a desert is the result. There is, however, no true desert region in Montana, although in places it approaches the desert condition. These regions are known as the **great plains.** In such regions the sage brush is a characteristic plant, although it is not so conspicuous an element there as in the more desert like regions.

When the clmate of a country makes conditions favorable for a certain **form** of plant life, then that **form** gives character to the landscape. If the grass and its associates give character to the region, then there is a **prairie formation.** If trees give a tone to the landscape, then there is a **forest formation.**

It may not be out of place to compare the relative capacity of these two forms of plants (the grass form and the tree form), to meet this danger of too great a loss of moisture. The danger to plants becomes greatest during the dry summer months and during the winter. As already shown, during the winter months the cold soil is not favorable to absorption, and if the plant be subjected to evaporation then, it is likely to transpire more than it can absorb. A cold soil then acts in a measure like a dry one, and the plant is in danger of excessive loss of water during the winter as well as during the dry summer months.

The herbaceous plants meet the danger of transpiration and freezing by dying down to the ground during the unfavorable season. The annuals of course are tided over this season in the form of seeds, and the perennials, beside seeds, have also underground stems. The latter, because they are protected by the soil, are in little danger of drying out. The woody plants, on the other hand, are exposed to all the extremes of winter. All trees are protected by their bark. In the young twigs this is not so thick, and hence these parts are more exposed than the older parts with heavy bark. So it is with the seedlings; for, although not so exposed as the older trees, the seedling stage of a tree is the most delicate one in its existence. If the dry season comes on before its root system is well developed, the seedling is very likely to perish. The seedling is subject to other dangers that will be mentioned in another connection. Those trees that shed their leaves are not so exposed during the unfavorable season as those that have their leaves the year round. Even the trees without leaves may be winter-killed. On the whole, then, herbaceous plants are less exposed during the dry and non-growing season than the trees.

Fires are detrimental to all vegetation, so it will not be out of place to compare the two forms with regard to their powers in resisting fires. A fire sweeping across the prairie may burn the surface clean of vegetation, but seldom if ever injures the underground parts. As soon as the season permits, the grass will spring up from these underground stems. Trees that have the power of developing suckers from roots will be protected in the same way. But few conifers have this power. However, the bark of old trees is often a protection against fires. The bull pine, Douglas spruce and western larch have thick bark and are protected in this way from fires that are not too intense. Young trees, however, succumb even to light surface fires, so acres of young trees may often be destroyed by fires that will not injure the older trees. The perennial herbaceous plant, then, has greater powers of surviving fires than trees.

Again, grazing animals are injurious to vegetation. The perennial grass is protected, because, when the top is eaten off, the under ground part is usually uninjured. Of course, if the above-ground green parts are eaten off so frequently that they have no opportunity to manufacture new food, the plant will be killed, and when the food stored in the underground stems is used up, then the plant will starve. Hence close pasturage is dangerous to the grass form. However, other forms of herbaceous plants that have an objectionable taste or are covered by spines or prickles will be avoided altogether by the grazing animals, or eaten only when nothing else is available. Sheep are the most destructive animals to pastures. The grass type has an advantage over some other forms of herbaceous plants in another respect. The growing region of a grass leaf is at the base, often below the surface of the ground. This part is less likely to be injured by fires or by grazing animals. As soon as the danger is passed, growth is resumed if the other conditions are favorable.

Young trees are subject to destruction by grazing animals. Especially is this true early in the spring, in the late fall, and in winter, for then there is often little to eat. Trees with needle-like leaves are protected more or less in that the needles, acting as prickles, are disagreeable. Yet even the shoots of conifers are often eaten. Young trees of bull pine and Douglas spruce have been found thus injured by cattle. Herds of cattle and sheep kill many trees in the young stages by trampling them. The older trees are less likely to be injured by grazing animals than the younger. The most important growing parts of trees, unlike that of the grass leaf is at the tip of the young shoot, and as this is the most tender as well as the most exposed portion it is likely to be eaten, by which the tree may be damaged or killed.

From the above it will be seen that the young tree is more subject to drought and is more likely to be destroyed by fire and by grazing animals than the perennial grasses and other herbaceous forms that grow in the prairie. In the drier regions, then, the prairie forms can exist where trees cannot, and even in regions where the moisture is sufficient to make tree growth possible, the occurrence of fires and the presence of grazing animals may favor the prairie rather than the forest. Of course, the forests that border on the prairie are open and prairie plants can exist there, but where the forest forms a heavy canopy, nearly all grasses are excluded, for as a rule, they require more light than they can get in the deep shade of the trees.

It should be emphasized that the seedling stage is the most critical period of a tree's life. Probably many trees could exist in drier regions than those in which they are found, if they could survive the juvenile stage. Especially would this be true of those trees that have deep and widespreading root systems, for they might later be able to get a sufficient supply of water from the soil to supply the excessive loss by transpiration. A number of successive favorable seasons no doubt permits some trees to be established in places where otherwise it would be impossible for them to get a start.

Another factor that is against tree growth is the prevalence of wind. Of course, occasional violent storms may destroy forests. But since on a windy day there is more water given off than on a still day, even moderate winds may be prohibitive of tree growth whereas the occasional storm only partially destroys it. Because this factor is not so obvious, it is often overlooked. Even if the rainfall is sufficient to support tree life, in regions of excessive wind trees are often absent. A good sample of this is found in contrasting the two sides of the Rocky mountains. At the east base of the mountains where the Great Northern Railroad crosses, there is a rainfall of twenty inches or more, with little or no tree growth. The west base in the Flathead valley with a rainfall of approximately twenty inches bears a luxuriant forest growth. In the former situations, the winds are excessive. In the latter, they are neither so frequent nor so strong.

From the above it will be seen that the main cause for the absence of trees in a greater part of the state of Montana is the lack of sufficient moisture. In some places, however, where there is sufficient moisture, winds, fires, and grazing animals may prevent the growth of trees and thus favor the prairie.

Montana Shells.

NATURE STUDY LESSON.

Morton John Elrod.

The state of Montana is not very productive of conchological specimens. The conditions are all against shell growth. The rivers are rapid, the water quite soft, and food in the rivers scarce. The large lakes, as Flathead lake, contain clear, cold water. They are usually deep, with rock bottoms, and surrounded by mountains with steep slopes. The marshy, stagnant parts of the lakes are usually small. The mountain sides in summer become dry and parched, except in protected portions and along streams. Great stretches of plain are without moisture for a portion of the summer, drying up almost every living thing that cannot move to the water-courses. The days are hot, the nights cool. In this mountainous state, where very little soil is lower than 3,000 feet above the sea, the air is dry and evaporation rapid. A passing rain cloud may leave considerable moisture, but it is soon taken up by the parched earth or evaporated if left on the surface. Stagnant ponds with decaying vegetation are few and confined to the vicinity of a few rivers. Even such ponds usually become dry each summer.

Most of the valleys were former lake beds of greater or less extent. As these lakes have been drained, they left swamps in which rhinoceroses, camels, three-toed horses, elephants, titanotheriums and other beasts became mired, their remains being buried for long ages. These swamps have dried up, and the waters have become more widely separated, now occurring as deep mountain lakes, or larger lakes, which are mere expansions of rivers. Such isolation must have caused the separation of shells of a species which naturally would take different lines of development. Accompanying this gradual separation of waters we might expect a region of moisture on the land adjacent to the lakes, giving suitable environment to the land snails.

As a result of the above conditions, we may expect great variations in adjacent regions, where the barriers may be sufficient to cut off all communication. There is very little doubt but that the isolated lakes in Montana and the northwest will produce interesting variations. But the sparsely settled country and the small number of collectors make the work of collecting and studying very slow.

The lack of lime in the waters of the state in considerable quantity is another element contributing to the paucity of shell life. Specimens taken from water invariably have thin or frail shells. Some are exceedingly delicate. The land forms, although not numerous in species. have thicker and heavier shells, affording much better protection. One species of slug, without a shell has been taken, but in small numbers.

In considering the above conditons it is apparent that collecting living shells is confined largely to the rainy season, i. e., the spring and early summer. While this is particularly true of the land species, it applies also to water forms. The pond inhabiting animals in spring are given more extensive territory, thus increasing the food supply and furnishing better opportunity for the development of the young. The rushing waters of the rivers, except in shallow and swampy areas along shore, are almost destitute of shells. In the western part but one bivalve is found in the sand bars of the rivers, the common black clam. **Margaritana margaritifera** L. In the eastern part, tributary to the Atlantic, two Unionidae are recorded, **Anodonta plana** L., and **Anodonta ovata** L. In each case only the young were taken. Three other small bivalves, to be found among the vegetation of ponds, have been collected, one from the western and two from the eastern part of the state. It is thus seen that the total list

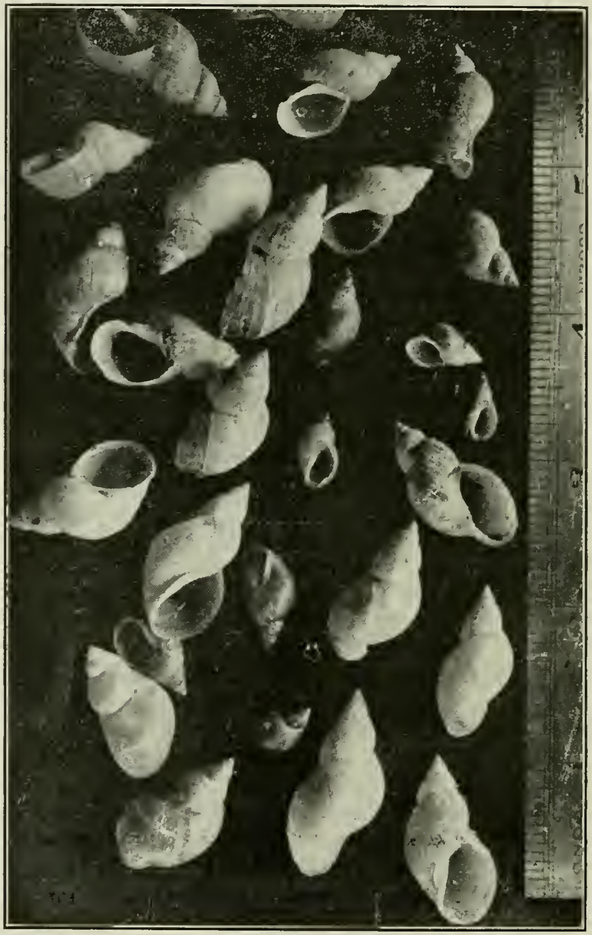


FIG. 22. *Limnaea palustris*, the commonest fresh water shell.

of bivalves inhabiting the waters of the state at present numbers but five species.

In most sections of the state rains are more or less constant in the state from early spring until the last of June. In May, June and sometimes early July, land forms may be hunted successfully. After this it is rare to find living animals except in very limited areas around lakes, ponds, or water courses. It is not uncommon to find bleached shells lying out in open and exposed places, but they are usually of one species, **Pyramidula strigosa** Gld., or some of its numerous subspecies or varieties.

To secure shells for the sanilery for class use is not exceedingly difficult, although they are not to be picked up at random. The water inhabiting species may be sought in shallow ponds, among the decaying or living vegetation. To secure them requires a pair of rubber boots, if one does not wish to have wet feet, and some form of a net for dipping them out of the water. The species in greatest abundance which is most likely to be taken is a small gastropod, with tapering spire, **Limnaea palustris** Muell. (Fig. 22). It is found throughout the state, may usually be had in abundance, and is not difficult to keep in the school room or laboratory. With it is likely to be had the smaller and more delicate **Physa,** with left handed turns in the shell. With these specimens in a vessel of water with suitable food a fund of information relative to their habits, movements and life may be secured. They will prove easy subjects for genuine work in nature study, and a large number of persons may carry on original observations. Other smaller species may be had possibly by sifting fine sand and separating the few shells to be had. I have kept many of these minute animals in vessels for months, and they have multiplied and done well. Those I have had were the diminutive **Pyramidula striatella** Anth., **Physa ampullacea** Gld., and **Limnaea palustris** Muell.

The land species must be sought in damp places. My most successful hunts have been in June on rainy days, although they may be had earler than this. It is usually necessary to search among the weeds and underbrush of the timber along the water courses or ponds, or in the damp canyons and gulches on the mountain sides. I distinctly remember several days in the Mission mountains where specimens were gathered. It necessitated crawling around on hands and knees among rank and dense vegetation, while rain was falling in torrents. While this was very disagreeable, it was the time when snails were active. Even when abundant they are difficult to find, owing to their color. They very much resemble the leaves and dead wood over which they crawl in search of food.

The snailery must be kept neat and clean, for snails are dainty creatures, and will not thrive in dirty cages. The water species will need occasional fresh water. The water of Montana's lakes and streams is so free from mud and silt, as a general rule, and so full of oxygen, that changes need not be made often. Once in two or three weeks will probably suffice if the vessel be large enough to hold a gallon or more. Water vegetation should be supplied, which will not only furnish food for the

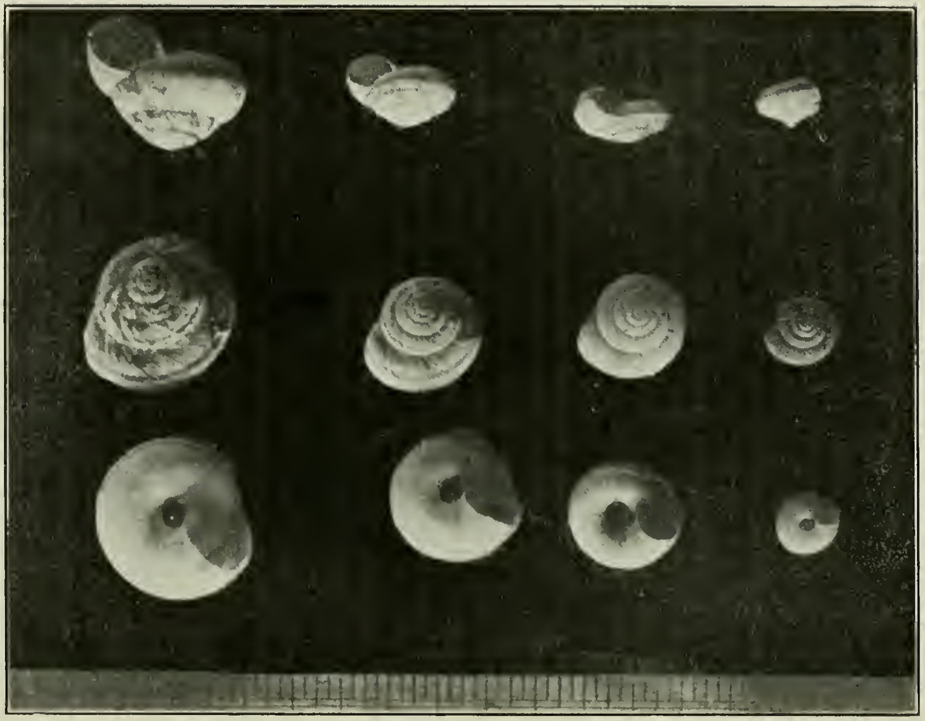


FIG. 23. A series of shells showing the varieties of Pyramidula strigosa due to high altitude. The largest, to the left, from McDonald Lake, altitude 3,300 feet. The next size, from Tobacco Root Mountains, east of the main range. The third, from the Bitter Root Mountains, altitude 5,000 feet. The smallest, from McDonald Peak, altitude 8,000 feet. Photo by M. J. E.

animals, but will also by its growth supply oxygen for their needs. I discover that pond scum may be kept growing all winter if placed in a south or west window for sunlight. Of course, water species may be kept in winter, when it will probably be found impossible to keep land species. In spring and summer the land snails may be kept in a suitable cage, and with a small amount of care and trouble in supplying food and in keeping the cage clean they will amply repay for the trouble. Pupils will find them interesting, and with a few suggestions will be able to make many valuable observations, and thus get true nature study lessons, a study of the living specimen whose habits and natural peculiarities may be known first hand.

The land snail most aboundant in the state is **Pyramidula strigosa** Gld. It is found abundantly west of the Rocky mountains at all altitudes from the lowest elevations to 9,000 feet. The shells found may easily be referred to several varieties. Figure 23 shows their general appearance. The shell is rather thick and heavy, recognized by two dark bands, one of which extends into the spire for several whorls. Closely related to it, and often associated with it, is **Pyramidula solitaria** Say, but the latter is more earthy, with darker color, a trifle flatter, and with broader bands, not extending into the spire. **Solitaria** is less common, and is not yet reported from east of the range.

Pyramidula strigosa has been taken by us abundantly in the western part of the state. It has been found on the slopes of many mountain ranges in the state. It has been taken as far east as Lewistown. It is a Rocky mountain species, and is so variable that conchologists despair of bringing the numerous subspecies and varieties into systematic relations which will be satisfactory. At two places in the Mission range, Sinyaleamin and McDonald mountains, it has been found at high altitudes, as explained in "A Biological Reconnoissance in the Vicinity of Flathead Lake." The lower snails are large and fine looking. The higher ones are very small, greatly reduced in size, and have very hard conditions to fight against in the struggle for a living. While the species is apparently of western origin, its presence at Lewistown shows that it has crossed the range, and is slowly making its way eastward. This is the second species, according to our studies, that has crossed the main Rockies, the other being a dragonfly. As there are seven species found in the state on both sides of the main range it is apparent that they have crossed the range in some way. As **P. strigosa** has been found at elevations up to 9,000 feet it seems reasonable to suppose that it was not carried over by some larger bird or animal, but crossed over by its own wanderings.

Several hundred duplicates have been collected, and two or three will be sent to any teacher of nature study, so long as they last, if postage accompanies the request for them.

It is needless, in this lecture, to atempt giving a list of the sixty species found in the state, twenty-five of which have been found west of the range, with forty-two from the east side. A list may be found in Bulletin University of Montana, Biological Series No. 3, pp. 170-174. Teachers who wish shells identified may send them to the writer, who will name them without charge. For much work in nature study a name is unnecessary, but it is very desirable. There are no keys available for identification of western species.

It will be seen from the above that the molluscan fauna of the west end of the state is entirely different from that of the east end, but seven being found on both sides of the mountains. As very few collections have been made it is very desirable that material be secured from various sections, and correspondence is invited on the subject and specimens very much desired. If teachers will suggest to pupils the desirability of gathering a few specimens the boys will probably bring them if they are in the neighborhood.

If the animals die, or if it is desired that they be killed so the shells may be used, the process of cleaning the shells and removing the dead animals is very simple. The shells containing the animals are dropped in hot water, and left for a few minutes. This quickly kills the animals and loosens them from the shell. The soft parts may then be removed by a bent pin or a piece of small wire bent at an angle at the end. Perfect specimen may then be made by washing out the inside with a pipette or small syringe. By gently rubbing the outside with a tooth or nail brush and water the outside may be shown off to best advantage. Such shells will ornament any school room or cabinet of collections.

Some of the suggestive points to which attention should be called may now be given.

Habitat. This includes the natural home, whether in water or on land, in the open or among dense vegetation. If among rocks the nature of the rocks should be determined. Shells found in water will suggest running water, sand banks, rocky bottom, shallow ponds, lake swamps, cold springs, or some other varying condition. Every phase of the environment should be noted, and suggestions thrown out for the purpose of having the pupils secure the information individually.

Movements. These may easily be watched, if specimens are kept in the snailery. It is very essential that the conditions in which the snail is placed should be as lifelike as possible, so as to be able to study movements that are natural and not forced. The animal may be watched while crawling around over the vegetation or along the sides of the aquarium. The use of the tenacles, the protrusion of the body from the shell, the withdrawal into the shell in times of danger, the action of the creeping foot during progression, and the movements of the mouth in feeding, all should be noted if possible.

Color and markings. Dead and bleached shells are not of much value, but are better than none. From them few conclusions may be drawn except as to size and shape. Teachers who understand the theory of protective resemblance will find shells suggestive of many things to which reference may be made. Those who do not understand it should make haste to consult some good zoology and discover its meaning. Shells generally resemble the surroundings so closely that they must be sought closely. I have frequently tried the experiment of searching a given spot carefully, to be followed by a second person who will see how many I have missed. A new spot is chosen and the order is reversed. Rarely will the second person fail to find some overlooked specimens, so closely do they harmonize with their surroundings. This blending of colors applies with almost equal force to the species living in water. Markings may refer to spots or bands on the shell, or to the indentations on the surface. This latter may be coarse or fine, deep or shallow, numerous or few. It may be possible to count the number per inch or millmeter, and thus determine points of variation.

The Spiral. This may be right or left handed, dextrose or levulose. Most shells are dextrose. If shells are in quantity each should be examined carefully to see if perchance an accidental specimen may be found the reverse of the ordinary. Such cases occur. Some species have the shells left handed, turning opposite to the hands of a watch. Each should be examined. The number of turns in the spiral should be counted. A means should be devised for determining the fractional turn at the last, as it is very likely to result in a fraction. By making count of a series variations will be found and a mean established.

Diameter and Depth. Adult specimens should be used. Three straight edges are necessary, one of which should be a finely graduated ruler. Place the shell against the ruler, and put the two remaining straight edges on either side, also against the ruler. The reading may be taken from the ruler directly. With a ruler and two square blocks any number of shells may be quickly measured. By turning the specimen measurements may be made in different ways, and variations noted. It is understood that the value of such work to the pupil depends largely on whether it is done **for** him or **by** him.

Variations. In a mountainous region shells of a given species from different localities or altitudes will show many variations. In fact, not two shells from any place are exactly alike. By noting the above points many lines of variation may be noted. It is possible to determine the direction toward which the species is tending; i. e., it is becoming thicker shelled, with deeper markings, broader bands, fewer turns to the spire, less width and depth, smaller in body, or the reverse. All such observations afford food for reflection, and are excellent mental stimuli. As this is the main thing sought in nature study work the observations should be encouraged by each individual, and not by the class as a whole.

Food. Few suggestions need be given on this. In the snailery different things must be tried. Daily observations may show whether land forms eat living or dead leaves, decaying wood, wet or dry leaves; whether water snails eat living plants or decaying material in the water, or living animals. All observations should be carefully recorded, and at stated times notes may be compared.

Enemies and Unfavorable Conditions. Drouth kills most land snails. Those living in water have no doubt many enemies about which little can be determined. Permit some shells to become quite dry and watch their actions. Notice the film across the shell to prevent evaporation. Other enemies to land snails are rodents, including mice and squirrels. If broken shells are found, examine carefully to see if the break is by accident **after** death, as by washing among rocks, or by an enemy **before** death. This must be determined by the position and character of the opening, as also by its recurring in a given manner. Observe whether the break is haphazard or shows evidence of careful selection as to place.

Geographical Distribution. Having found the name of the specimen in the snailery, it may be possible to find how extensively it is distributed over the state, over the United States, or over the world. This information may be had by consulting a library with conchological literature, or by inquiry of friends versed in knowledge of shells. In any event, whether the information is found or not, suggestions may be thrown out as to ways by which the species may be scattered, reasons for dispersal, and barriers which may prevent it.

Some Devices Tending to Insure Cross-Fertilization of Plants.

Maurice Ricker.

The oak has a wind-pollinated flower. In some plants the pollen is carried by water. A large number of the conspicuous flowering plants are pollinated by insects, bees taking the leading part, though moths, butterflies, flies, beetles and bugs do much of the work. Some of the deep throated flowers, as the honey-suckle, are pollinated by the humming bird. Other especially adapted plants are said to be pollinated by snails.

Christian Konrad Sprengel was a pastor in a German parish until he neglected his duties, to the extent that he lost his position. This neglect came about through his love of the study of plants. He then made a precarious living by teaching the languages and mathematics, and continued his investigations, the results of which appeared in 1793 in a volume entitled "Das Endeckte Geheimnis der Natur." He shows in this book a perfect understanding of the nature of fertilization and believes that insects play a part in putting pollen upon the stigma. Waetcher in a memoir in 1801, taught the structure of the orchid pollen-mass, or pollinia, as it is now called, and showed that it must be removed by an insect.

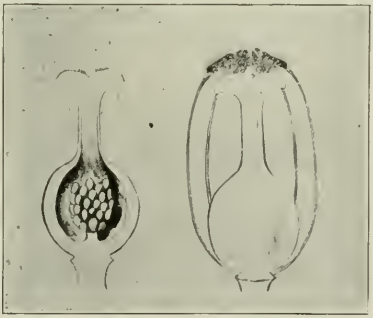


FIG. 24.

It remained for Darwin to discover the real secret of nature. He approached the subject through experimentation upon flowers fertilized by their own pollen as contrasted with those which are fertilized by the pollen of other flowers. His book on the "Fertilization of Orchids by Insects" appeared in 1862, nearly 70 years after Sprengel's work was first published in Berlin. We have illustrated the difficulties in the way of accepting Sprengel's work and Darwin's final solution of the problem by four charts, after Gibson.

The first (Fig. 24) shows how Sprengel taught the method of fertilization by showing how the pollen is shed upon the stigma by being borne above it.

The second chart (Fig. 25) shows how Sprengel overcame objections to his theory when his attention was called to flowers which bear the anthers below the stigma. It shows bees crawling over the nectaries, incidentally smearing themselves with pollen, and then climbing over the stigma, carrying the pollen with them.

The third chart (Fig. 26) shows the next problem with which Sprengel was confronted. Flowers were found where the pollen is all shed before the stigma is open or receptive to pollen. These are what we now call proterandrous flowers. Somewhat similar in nature is the problem of the proterandrous flowers where the stigma ripens before the anther. Sprengel is said to have admitted that he could not solve all these enigmas but that, nevertheless, he thought there were reasons for these various structures.

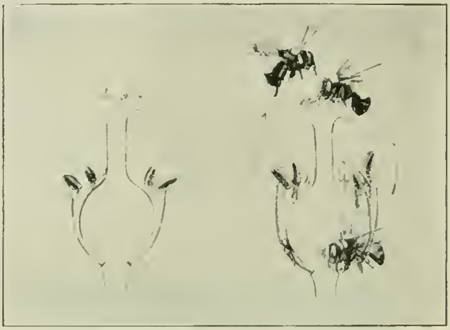


FIG. 25.

Darwin, coming at the problem from the standpoint of cross-fertilization, saw it as in chart four (Fig. 27), which represents bees going from the ripe anthers of one flower to the receptive stigmas of older flowers; and it was made clear.

In his twelve years of experimentation on the subject of "Self and Cross Fertilization in the Vegetable Kingdom," Darwin showed that not only was it advantageous for flowers to be fertilized by pollen of other flowers of the same species, but that they produced more seeds if fertilized by pollen from distant fields. These two books by Darwin are of great interest to the botanist and may be read with profit by any one. As examples of the exprimental method of to-day they are worthy of consideration. I suppose no other man has sepnt such years of painstaking labor and accompanied his theories with such an enormous amount of data.

Some plants, like the common violet, have two kinds of flowers. We only note the ones that open to insects with their beautifully colored corollas, but there are others, which may be found later in the summer on the same plant. These do not open but shed the pollen upon the stigma, in the mud, as we might say. These are called cleistogamous flowers and I believe are borne only upon those plants which also produce the ordinary showy flowers, thus insuring cross pollination at some period in their history.

Many flowers provide against self-pollination by some such common device as in the bluet (Houstonia), where some flowers bear the anthers in the lower part of the cup and the stigma near the top, while in other plants adjoining and perhaps raised from seed from the same plant, the opposite arrangement of anthers and stigmas is found. One can readily see how this will result in preventing self-pollination and furthering cross-pollination.

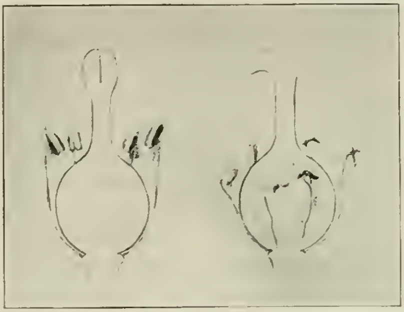


FIG. 26.

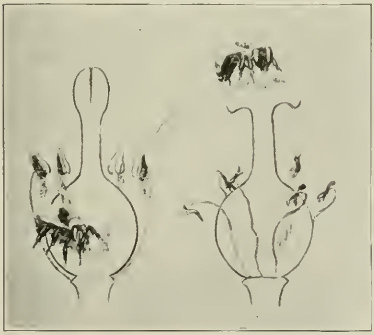


FIG. 27.

A still more effective method is found in many flowers where the parts mature at different times, as has been already mentioned. The most effective method, however, is shown in those plants like the willow where only pistillate flowers grow on the one plant and only staminate ones appear on another. These are called dioecious plants. The oak represents the type where the two kinds of flowers are borne separately on the same plant. These are called monoecious plants.

As might be supposed, those flowers which depend upon wind pollination must produce a great abundance of pollen, even though every device such as light feathered pollen be brought into use. The monoecious rag weed and the pines are good examples of plants which shed their pollen freely. We can readily see how great would be the benefit to a plant if an insect could be induced to carry its pollen. The saving in quantity would be considerable, as well as the advantage before mentioned of pollination from a distant plant.

Since there are no one sided bargains in nature the insect must be enticed and paid for his trouble. This involves the necessity of the plant's putting up some kind of a free lunch in the shape of nectar, as in the clover, or edible pollen as in the rose. In the Spiderwort we have some fine hairs growing from the stamens which must make delicious fodder for some of the bees, judging by the way they eat it. Some plants offer lodging for the night and protection from storm and cold. What more could a vagrant insect ask?

The fact that this free lunch is offered must be advertised, either by an odor to entice the hungry insect or by a showy blossom. Some plants with small inconspicuous blossoms, as in the clover, unite into heads so the busy bee can readily go from one to another without loss of his valuable time, for the summer is short.

One can follow out this idea almost indefinitely. Plants blooming at night have white flowers because they can thus be more clearly seen by their nocturnal visitors. They are also more likely to be fragrant. Flowers desiring nocturnal visitors are likely to be closed the rest of the day. Flowers that are open for business only a very short time, as the morning glory, have not only showy flowers but delicate stripes of color running from all sides down to the nectaries, seemingly to direct the insect to the sweets with as little loss of time as possible. These nectary guides, as they are called, are very conspicuous in many insect fertilized flowers. By following these guides, the welcome host will always rub against the essential organs of the flower and thereby assist in pollination, or in other ways pay for his sup of nectar.

It may be interesting here to note that the early botanists thought nectar was a waste product that must be removed, and an early suggested reason for insect visits was to assist the flower in its removal.

While most insect-fertilized flowers are beautifully colored and many of them pleasantly scented there are also some that are flesh-colored. They have a bad odor, as the smell of decaying meat. The visits of carrion flies suggest the purpose of the bad odor.

Sir John Lubbock made an interesting series of experiments from which he deduced the facts that dull yellow, brownish or purple flowers seem to attract flies more especially. Also that bees and butterflies are more likely to go to violet, red or blue flowers. Packard believes that no insect can distinguish clearly color or objects at a greater distance than six feet. What extremely short sighted animals they are! We know that odors will attract flies from much greater distance.

The insects, as well as the flowers, are modified to meet the conditions that arise from this inter-dependence. When Darwin's book was under discussion soon after its first appearance, some one brought a flower from Madagascar which had a nectary measuring seventeen inches. Some were inclined to ridicule Darwin's theory and ask him to produce the insect having a tongue long enough to reach the sweets at the bottom. Though no such an insect was known, Darwin readily accepted the challenge and declared that he would stake his theory on the proposition that somewhere there was an animal capable of reaching it, else there would have been no such development. His critics were much disconcerted soon afterwards by the finding of just such a moth as Darwin had said there must be.

Let us consider some of the devices for preventing waste of pollen in insect fertilized flowers. We can readily see that after a plant has specialized to such an extent as to secure transfer of its pollen by certain flying insects only, that it may be necessary to arrange some means to keep out a large class of crawling insects, like the ants, which might seek to take advantage of the food and at the same time be of no use to the flower. They would not be adapted to transfer pollen to another plant in good order. The nasturtium for instance has numerous bristling hairs that bar the way to the nectary. The snow-berry has a perfect ball of cotton over its sweets. Some plants as the sunflower have such spiny, hairy stems as to discourage creeping visitors. Other plants secrete sticky gums which act very much in the same way as hairs, in that they are a serious impediment to insect travel. Some plants, like the milkweed, have smooth, waxy stems which are easily punctured by the sharp claws of a climbing insect. When the plant is injured the sticky milk will flow out and one can readily understand how disgusted an ant would soon become with such a plant. The rubber plant has sticky sap for the similar purpose of self protection.

Numerous schemes for prevention of visits by any other than the favored guest might be cited. The nectary is often located in long spurs where only long tongued insects can reach it. The columbine has five such spurs. The common flies and bees cannot disturb this flower. It reserves its nectar for certain long tongued insects. The bumble bee sometimes thwarts nature's scheme by alighting on the outside of the flower, and cutting a hole for a back door, as it were, drains the nectaries dry without having touched the essential parts of the flower. If this ingenious device of the bumble bee should become universal among bees it might have a serious effect upon the plant's survival. It would then have to depend upon allies of the butterfly order, who carry no knives, to make the first call.

One of the most astonishing tricks in the plant world is played by the blue flag or iris. One must examine a flower and find the parts to fully appreciate the situation (Fig. 29.) At last you will find the false honey guides running down the interior of the flower and Needham reports that many insects seem to make the very natural mistake of probing down the center of the flower as indicated by the guides, for the nectar. They find nothing and go away no doubt with a poor opinion of the flag.

A bumble bee, for whom the flower seems especially designed, alights

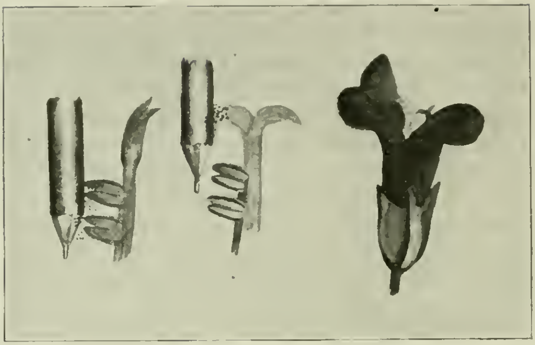


FIG. 28.

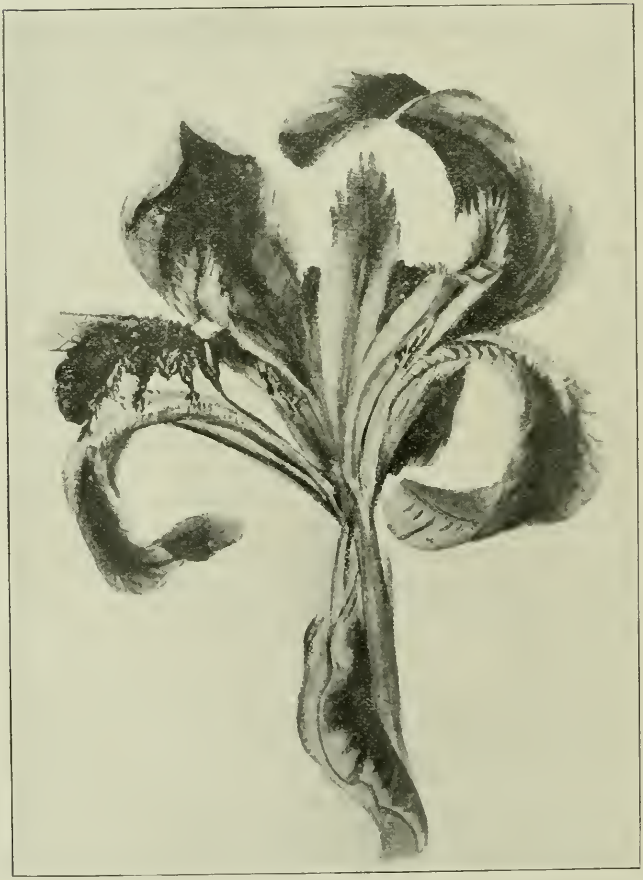


FIG. 29. The blue flag. From water color drawing by Mrs. Edith Ricker.

upon one of the graceful sepals and his weight is just sufficient to separate it from the closely covering carpel. The bumble bee then wedges himself in between the slowly opening part and, by stretching his long tongue to its full length draws the nectar from its deep well. The true honey guides are on the upper surface of the petal. The cover is a style and bears the stigma on a shelf like projection just where the bee will rub his head and thorax in wedging himself in. The stamen rises and bears an anther at the point where it wil rub the pollen into the thoracic hairs of the bee. Why is not this same pollen left on the stigma when the bee backs out? If the stigma shelf is rubbed with the finger it opens outward as by a bee in entering, and closes when rubbed the opposite way. Thus the pollen gathered from this flower will be transferred to some other flower. The blue flag teaches us several lessons in adaptation. All of the irregular flowers are peculiarly shaped with reference to their insect visitors. They are a source of never ending speculation.

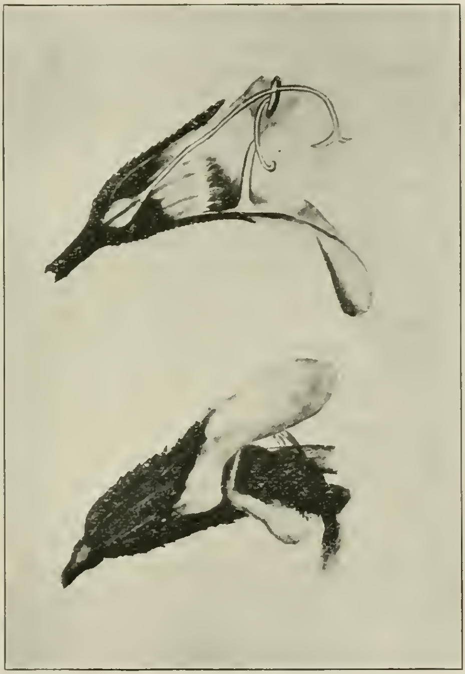


Fig. 30.

Protective closure to keep out rain and unwelcome insects has been mentioned earlier. The hanging position of many flowers serves the same purpose. Many flowers have a movement of parts in addition to this closing, some of which are of great interest. My attention was first called to a closing of the lips of the stigma in the catalpa. Near the station, at Big Fork, is a swampy place where many interesting plants abound. On inspecting a number of blossoms of Mimmulius (Sp—) (Fig. 28) I found the styles different in various plants of all ages and proceeded to tickle them with a straw. The style divides into two flat surfaces at the end which spread widely apart, as is so often the case. Selecting one that was well open. I found on touching it that it closed slowly and in perhaps thirty seconds was shut up as tightly as if it had never been opened. After a few minutes I visited the plant again and found it was slowly opening. The plants taken to the laboratory for experiment did not stand the trip very well, and reacted somewhat more slowly than in the field. When fertilized with fresh pollen from another flower the style will remain permanently closed.

We now come to one of the most interesting arrangements in the botanical world illustrating plant movement to bring about cross pollination. The sage was figured in Darwin's earliest work of this kind and given to the world as a wonderful piece of floral mechanism.

The sage flower is irregular, having one of the petals produced into a landing place for flying insects (Fig. 30.) The anthers are modified with a peculiar arrangement which can be better understood from the figure or the section of the flower. Two standards carry each a sort of C shaped piece, which is delicately poised so as to stand in a nearly vertical position, if the flower is held horizontally . A bee in order to enter the flower must go between these standards and in so doing will necessarily push the lower part with his head and rock the anther bearing part over so as to dust his back with the powdery pollen. Since the sage is proterandrous, the stigma will be non-receptive even if it were far enough out to receive the pollen. If the next sage visited has a ripened stigma the style bearing it will have grown long enough and will curve down so that it must rub the back which was lately dusted with pollen. The bee will receive no pollen from such a blossom as its pollen has all been scattered. The sage has indeed a wonderful story to tell to those who will stop to consider it.

Certain flowers greet the entering insect with a bombardment of pollen. This is produced in various ways and does not seem to be anything of a surprise to the visitor who proceeds to collect his fee for carrying his load of pollen to the next flower.

Our common Milkweeds have a waxy pollen mass and will need investigation. They have been charged with the murder of hundreds of innocent guests and any summer day one may find them holding their dead victims fast by the legs. The insect finds himself caught and is perhaps, unable to pull his legs out of the trap or pull the trap with him. This trap, which consists of two bags of pollen, he is supposed to take with him. An insect's foot, coming into contact with the V shaped slit in the trap formed by the union of the two pollen bags, is quite likely to be caught. If the pollen be ripe, and normal in every way, any ordinarily strong insect is able to pull the pollen sacks free from the flower if he does not get too many feet caught at the same time. If he has a foot firmly fastened in one flower and in trying to pull out tangles another foot or two, he may tire himself out and die after a hard struggle. Insects usually succeed in pulling out the pollen sacks. These they carry to another flower, and drag over the stigma with the desired effect.

The orchid represents the most highly specialized flower and a consideration of these wonderful forms must be left until another time.

The Plant Associations.

Harry Nichols Whitford.

From what has been said in the preceding pages it can readily be seen that the climate affects the distribution of plants. The so-called **plant formations** are the direct result of certain climates. However, the landscape of a **forest formation** (Fig. 5) does not show an equal distribution of the kinds of trees in it; nor does it show an unbroken mass of trees. On the other hand there is a tendency for trees of certain kinds to be growing together, and there are gaps in the forest, island-like openings, as it were, in the sea of trees. The gaps may contain a meadow, a heath, or even a prairie. A **prairie formation** may also contain trees in certain favorable situations (Fig. 5) where there is a sufficient water supply. In distinction from the **formation** these groups have been called **plant associations** or **plant societies.** It is now in order to inquire what causes have brought about the division of **formation** into **associations.** This can be done best by selecting a limited region in the forest formation, for example, and by noting what associations are found and in what conditions they are growing. The region around the Montana Biological Station at Big Fork is a good one to illustrate the point. Any region in the state can be studied in the same way, whether it be in the prairie or forest.

In the **forest formation** near Big Fork there are five more or less distinct **plant associations.** In the low places in the Swan river valley along streams and around ponds are moist areas that are usually submerged during the spring and early summer months. These are known as **meadow associations** (Plate LII.) The grass type prevails in these places, grasses and sedges of various sorts being here associated. Oftentimes peat moss is abundant, and with it may be found the interesting carnivorous plant called sundew. Around the borders of the meadows, and sometimes in them, are willows, alders and birches. Shallow ponds containing water lilies and pond weeds are often found in the meadows. It is very evident that the reason why trees do not grow in these meadows is because there is too much water, which, like too little water, is injurious to them.

Bordering on the meadows are localities, not quite so damp, where the Engelmann spruce and other plants growing with it are found, forming what may be called the **Engelmann spruce association.** On the edge of the meadow the trees of this association are small and scattered. Depending on the amount of water in the soil, there may be peninsulas and islands of spruce in the meadow. Sometimes there are almost pure stands of spruce forests; again the spruce element is scattered along streams. Very often lodgepole pine, narrow-leaved cottonwood, aspen, and birch are associated with the spruce. These particular combinations of trees are always found in soil that is quite damp, but not so damp as the soils in which the meadows occur. It must not be supposed from what has been said that the trees mentioned above never grow in other situations, for they do, as will be seen later. In the spruce associations they are the predominant trees. In some of the other situations, they are subordinate.

Around the drier borders of the spruce association, and sometimes on peninsulas or islands in it, are stands of trees other than those mentioned. These trees are clearly associated with soil in which the water level is still further beneath the surface. Because the western larch and the Douglas spruce are the most common trees in this stand, it will be given the name of **western larch—Douglas spruce association.** Far the greater part of Swan valley is occupied by this association. Other trees in it are the lodgepole pine, lowland fir, silver pine, and occasionally an arbor-vitae. The Engelmann spruce and the birch are sometimes present also, though they seldom form a conspicuous element. The lodgepole pine (Plate LII) occupies vast tracts of this area. Its presence here is clearly due to fires. Often the older trees of western larch and Douglas spruce, their charred trunks telling the story of former fires, are seen standing above young forests of lodgepole pine. Sometimes almost consumed trunks show that the fires have been more destructive. The western larch and the Douglas spruce are the last to be killed by fires, because they can resist them best. Where fires have not been so destructive, the lodgepole pine is less conspicuous. Indeed, in places it is almost entirely wanting. The lowland fir, silver pine, and Engelmann spruce are more abundant in the moister parts of the western larch-Douglas spruce association. In isolated patches the bull pine is also found.

Just as the meadows form treeless places in the forest formation so occasionally the **soil** may be too dry to form forests. It is a well known fact that clay soil holds water better than sandy soil. The rainfall may be sufficient to support trees in the former, where it would not do so in the latter. This fact may account for the prairie "islands" in the **forest formation,** to be seen in Fig. 5.

Surrounding these prairie islands and bordering on the **prairie formation** is another type of forests which is due primarily to the fact that there is more water in the soil than in the prairie, and less than in the western larch-Douglas spruce association. This type of forest may be called the **bull pine-Douglas spruce association,** because these two trees are the predominating ones. Sometimes the western larch is found with these, but it never occupies the drier soils. In other places the Rocky mountain juniper is present. The bull pine-Douglas spruce forest usually is an open one, with grass patches between the trees. It grades imperceptibly into the prairie formation.

In the foregoing it is shown that the type of plant associations in the forest formation depends on the amount of water in the soil. Warming, a Danish botanist, who was the first to fully perceive this relation between the grouping of plants and the amount of water in the soil, classified plants into **hydrophytes, mesophytes,** and **xerophytes.** Those plants that grow in soils with a great amount of water in it are known as **hydro-**

phytes. This word comes from hydor, meaning water, and phyton, meaning plant. Those plants growing in soils with an intermediate amount of water are known as **mesophytes**, that is, literally intermediate plants. Those plants growing in soils that have little water, are known as **xerophytes**, that is, dry plants. Now it is convenient to use the terms **xeromesophytes** and **hydromesophytes.** So under this classification the associations discussed above are as follows:

A wet meadow is a hydrophytic association.

An Engelmann spruce forest is a hydromesophytic association.

A Western larch-Douglas spruce forest is a mesophyitc association.

A Bull pine-Douglas spruce forest is a xeromesophytic association.

A prairie is a xerophytic association.

In the **prairie formation** there are two places where trees may grow, namely, along streams and on protected hill sides. It is obvious that in the former situations the roots of the trees penetrate to or near to the underground water level, which is not far from the surface. In the latter situation (Plate LII) the fact that trees are protected from drying winds and the soil from the heat of the sun, prevents both trees and soil from drying out rapidly. The plants that grow there can get more water and give off less than they would absorb and transpire if the hill were not present. Thus the protected slope of a hill may have forests in a **prairie formation.**

Again, if a hill be high enough to cool sufficiently the moisture-bearing winds so as to cause precipitation of moisture, it may get more rainfall than the lower lying land. This is very probably the reason why the tops of mountains or of high hills in prairie regions have trees and sometimes dense forests. This leads to the dicussion of the forest conditions in high mountains.

The climate towards the top of a mountain is different from that at its base. It is always colder and usually more moist. The moisture conditions are favorable to trees, the low temperature conditions are against tree growth. The slopes exposed to dry winds have less moisture for trees than those not so exposed. At the same time the exposed slopes receive more heat, rapidly melting the snow, which would otherwise lie longer, and thus shorten the season. As a consequence tree growth is more prevalent on these slopes than on the protected slopes where the snow lies the year round. As one ascends a mountain like MacDougal's peak or Hall's peak, which are in the Swan range bordering the Flathead valley on the east, the species that require the most heat will disappear first. Those that are adapted to a shorter season will be found higher up. The bull pine is one of the first to disappear. Higher up the western larch and silver pine are absent, and on the ridges the Douglas spruce and lodgepole pine are the last of the lowland forms to disappear. In the valleys the Engelmann spruce will be found as high as these or higher. Before the conditions are too severe for the last three named species, the alpine trees come in. In the region under discussion these are the white-bark pine and the alpine fir. (Plate XLVII.) It has already been shown that the latter species is found occasionally in the valley. In the cold canyons it and the Engelmann spruce may form almost pure forests. Near the top of the two mountains under discussion, the exposed places have only the two alpine trees, the white-bark pine and the alpine fir. In basins on the east side, however, the conditions are different. Here the snow lies longer. The white-bark pine is infrequent here, but the alpine fir does better than on the exposed ridges. In the basins there are three distinct plant associations. On the steep slopes where the weathering processes are frequently adding new rock material, (Plate XLVII) the conditions are too strenuous for the existence of any plants. As soon as one of these talus slopes becomes stable enough, then plants begin to get a foothold, and finally trees may appear. In places where the snow lies the year around, there is no vegetable life except the simple one-celled plant known as the "red snow." Bordering on these snow banks are the so-called alpine meadows. (Fig. 31.) They usually follow up the retreating snow and sometimes dog tooth violets, spring beauties, and anemones come up through the snow itself. Thus one can see these forms just appearing on the border of the snow field. At a little distance they are in full bloom, further away where the snow has disappeared earlier they have produced seeds, and still further from the snow they have finished their growth and have died down to the ground. It is usually in the latter places that one finds groups of trees, (Plate XLVII) nearly all alpine fir, for they appear where the snow first melts. Thus there is a relation between the plant societies found in these regions, and the time snow lies on the ground.

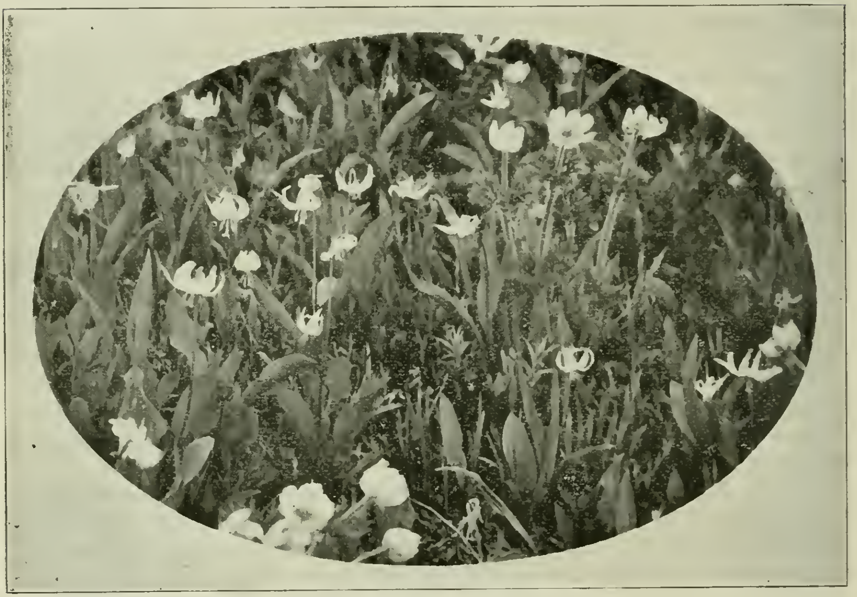
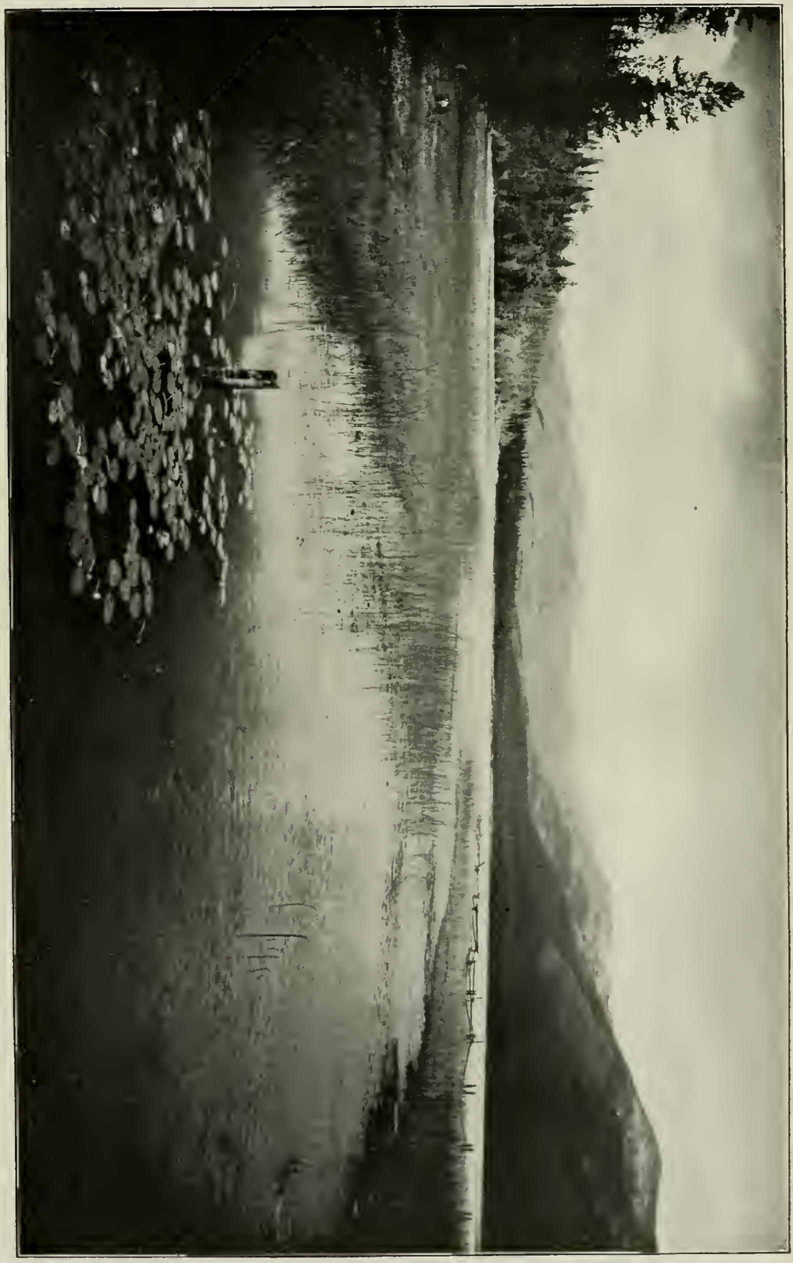


Fig 31. Portion of an alpine meadow, 7000 ft. altitude, Swan range, August, 1903. Photo. by M. J. E.



General view of Rost Lake from the outlet. The Swan Range of the Kootenais is in the distance. Around the lake are tree or forest plant association. Bordering these are meadow societies. In the water are hydrophytic forms.

Bird Music in the Flathead Region.

Perley Milton Silloway.

Bird music is the blossom or flower of bird life. The plant is with us throughout the summer and perhaps throughout the year, but its fragrant flower attracts our attention during only a limited period of its summer life. So it is with the bird song; it reveals a life that may have been neglected until that time, and for a brief period we wait and listen for the bird. A little later the song dies away, and the author is likely to be overlooked during its further existence among us.

The bird song is an index of a changing phase of the bird's activities. Its hundrum habits of the workday world are to be laid aside for a time, and it is to enter upon a brighter and more joyous period of its yearly round. New impulses actuate its little breast, and its kindling spirit leaps forth in song. For weeks and months it has been silent, except in such calls and cries as have been impelled by its usual emotions, but as it sees its little world enlarging to renewed companionship and more enjoyable relationships, it gives unusual utterance to impulses newly aroused, and the song becomes a part of its daily experience.

As is well-known, the gift of song is generally confined to the male bird. Though the rule is not invariable, the exceptions are few enough to prove the rule. The fact that the male bird alone produces the real song has led to the conclusion that the song is a means by which the male announces his presence to his lady-love, and by which he seeks to attract her attention to his graces and accomplishments. Bird music is the forerunner and accompaniment of the mating season, and continues through what may correspond to the "honeymoon" of more rational beings. The song is prompted by the sexual instinct, and in the mating season is doubtless designed to please some listening female. Once her attention is attracted and her ear captivated, the song becomes one of the ways in which she is wooed and won. After she has been won, the song becomes an index of the domestic bliss of the songster. With many birds, the season of song ends quite abruptly with the beginning of the female's household duties; with a few, the period of song is prolonged even until the younglings have left the nest and are able to forage for themselves. In some instances, there is what appears to be a fall period of song, though the fall singing of any bird seldom equals its vernal performances in power and volume.

Some of the birds come to us on their way northward in the spring, caroling in the renewal of their domestic felicity. During the weeks of winter we have missed the presence of the songsters, but on some auspicious morning we hear the old familiar carol, and we note that one of our avian friends of last summer has returned to us. So our bluebird comes to us, and sitting in the top of a convenient tree or on the ridge of some low building, it warbles its tender message of the returning spring. For several weeks after the advent of the bluebird, the lowvoiced utterances of this species charm our ears. Then the songs cease in frequency and spirit, even before the sitting bird has seen her younglings break the delicate blue-tinged shells. When we arrive at the Biological Station for our annual summer outing, the voice of the bluebird has been hushed, so far as its song is concerned; its tender calls, however, can be heard as we chance on the birds flitting from the deadened boles of the adjacent ridges. To some of us, at least, these calls are a plaintive reminder of the earlier song season, and are worthy of a place in our thougths regarding the bird music of the region.

Of our familiar western robin, what shall we say that has not often been said? In his usual business-like way, he comes from his southern sojourn, squeaks about the neighborhood for a day or two until he gets his bearings and ascertains that everything is as it was when he departed late in the preceding autumn. Then he begins his recitals, generally from the topmost branch of the tallest tree in view, giving his lyric as a fitting ending to a day that has begotten in us a genuine case of "spring fever." There are but few feet in a verse of robin music, and that verse is oft repeated. Florence Merriam has quite accurately described the song in syllables "trill-er-ee, trill-er-ah." Generally the song is enunciated in a loud, hurried manner, so nervously that it appears as if the songster were losing breath; at times, however, the song is uttered in a high, squeaky falsetto tone, the same performer sometimes changing from one tone to another at will. Again, the singing is done in a low, subdued tone, for our friend robin frequently drops into a poetic mood, especially if his fair charmer is sitting near, and often whispers his flatteries into the ears of his promised bride. The song season of the robin is longer than that of the bluebird, and in this region is prolonged by some individuals well into July, the late songs, however, being heard chiefly early in the morning and less frequently late in the day.

As we skirt the shores of Daphnia Pond (See Plate XLIX) in quest of biological specimens, the singing of the catbird greets us like the strains of familiar music. Nowhere in this region is this gifted songster more numerous than on the enchanted shores of Daphnia Pond. In the bushes there the catbird nests until late in August, and as it thus prolongs its domestic duties, it carries the spirit of song far beyond the season common to most of our bird musicians. Sitting in some secluded nook of the bushes, this songster gives expression to its impulses in voice low and sweet, in most fitting accord to the fast ebbing tide of summer bird music. The opening hours of the day are generally used by the catbird in its recitals of the later season. At such times we must rise early in the morning if we want to hear the birds begin to sing. In the cool morning hour the catbird is at its best, and if a nest is anywhere in the neighborhood, the listener is certain to be regaled by a prodigality of wildwood music by the gifted owner of the household.

The warblers, notwithstanding their name as a group, do not excel generally in musical powers. Many of them, though, are songsters of no mean ability. The vocal power of the warblers that occur in the Flathead region serve about the same function in the woodland chorus as the side-horns in the instrumentation of a large band. They are not soloists nor leaders, but they furnish the harmony in accord and accompaniment, and thus aid in bringing about an effect which is quite satisfying to the listener. So it is with the efforts of that gem of the swamp-woods, the American redstart. Its song is short, ringing verse, very similar to that of the yellow warbler, and is repeated from time to time with great energy and earnestness. Like the catbird, the redstart nests comparatively late, and hence its singing is an incident of our life at the Station during these summer sessions, in the early part of July.

Any of us who has been so fortunate (or unfortunate) as to have been delayed at Selish, may have heard the peculiar notes of the long-tailed chat in the bushy tract near the depot. The chat itself is one of our beauties, a yellow songster somewhat smaller than the catbird. No other bird, unless it is one of the smaller sparrows, understands so well and practices so much the art of skulking. When you are looking for the chat it is certain to be behind a convenient tangle of branches or foliage. Its music, though, will continually come to your ears, not in song, but in a series of strange whistles, suggestive of schoolboy signals, and uttered in varying intonation. It is to be hoped that the chat will work its way northward and establish itself among the bushes of our classic Daphnia.

(In 1903 the chat appeared in the bushes of Daphnia and its song was heard daily.)

Another warbler whose song can not be overlooked is the western yellow-throat. This handsome songster skulks in the reedy tangles of Daphnia Pond, and there its energetic singing regales us who have an ear open to the voices of the birds. The song of the yellow-throat is ān accompaniment of the July afternoons, for this warbler has a note till the end of the nesting season. The usual production may be represented by the syllables "wich-i-ty, wich-i-ty, wich-i-ty," generally in series of three, with the emphasis on the leading syllable. It is a loud, ringing song, uttered with persistence throughout all hours of the day, and always from some low situation. The songster is a handsome little yellow creature, easily identified by the band of black which marks his upper face and forehead. His less musical spouse lacks the black markings, and is not so readily distinguished from other small yellow birds, but she may be known by the rich yellow of her throat on the under side.

The two representatives of the vireos fill no mean place in the avian chorus of this region. Both are persistent songsters, and through all the summer their voices can be heard mingling with other wildwood performers. The warbling vireo utters a series of hurried, subdued measures, characteristized by a plaintive intonation, forming a most pleasing song in gentle accord with its surroundings. The song of the red-eyed vireo is a loud, monitorial repetition of three or four syllables, easily identified by its peculiar delivery. This songster has been called the "preacher" because of its monitorial style of execution in its singing. Wilson Flagg has aptly translated the song of the 'preacher" in these words: "You see it—you know it—do you hear me,—do you believe it?"

The vireos are unlike most of the birds in the manner of their singing, as they prefer the shade of the foliage of the deciduous trees they haunt, and do not choose a perch out in the bright sunshine from which to render their measure. Again, they do not sit and sing simply for the sake of singing, like many of our songsters; their singing is incidental, uttered as they appear to be busy in gleaning their daily bread from the foliage of the trees. The female of the warbling vireo is equally gifted with song-powers with her mate, and she has a pretty habit of singing in response to her spouse while she is sitting on her nest.

In respect to song, the cedar waxwing is one of the most peculiar birds we have, for it has no real song. The only utterance of which the waxwing is capable is a soft lisping call. Even in the mating and nesting time the waxwing can voice its emotions only in these feeble lispings, which are scarcely forcible enough to be described by our idea of the word chirp.

A voice of considerable importance in the bird music of this region is that of the Louisiana tanager. This songster frequents the coniferous trees of larger size, where its bright yellow attire, ornamented with black wings and crimson head, seems in strange contrast to the dark evergreen of its environment. The song of the tanager is much like that of the robin, so much like it in fact that the listener must discriminate very closely to distinguish the difference. The tanager's singing is more nervous, and more sharply uttered, lacking the full treble of the robin's performance. This splendid gem of the coniferous woodlands is not sparing of its music, and continues in song well into July. Its frequent recitals serve to apprise us of its presence near the Station; even from the Station door we may hear its characteristic song from the tall conifers that line the river's bank.

Another songster of late summer is the lazuli bunting. It frequents the roadsides, singing a-perch of telephone wire or in the top of some tall tree. Its song is a pleasing little ditty, uttered with great persistency and considerable spirit, though with little variation. The performer may be known by his coat of indigo blue, his orange-tinted breast, and light underparts. He is a little fellow, scarcely larger than our chipping sparrow. His continued ditty is probably prompted by a cozy cot of dried grass in the bushes below or in the near neighborhood, in which his more demurely attired spouse is nestling her pale light-blue eggs.

The black-headed grosbeak contributes a generous share toward the bird music of this region This songster has a rich, full voice, and its song is somewhat like that of the robin or that of the oriole, what might result by a medley of the songs of the two lyrists mentioned. The grosbeak frequents the deciduous trees, perferably the dwarf trees in low situations, in company with the vireos, redstart, and cedar waxwing. It is also a songster of late spring and early summer, and consequently we hear its mellow music in the early part of July. Like some others we have mentioned, the black-headed grosbeak is well at home on the shores of Daphnia pond, where it rears its brood in the low trees. The male is a model husband, for he is noted for his care of the household. He it is who sits at home brooding the eggs, while his spouse visits about the neighborhood with other grosbeak dames. When the youngsters are ready to leave the parental roof, it is the male who usually takes them in charge and instructs them in the way of making an honest grosbeak living.

Another songster of the bushes is the arctic towhee. It prefers the shrubbery in the neighborhood of ponds and streams and lakes. Its song is not a masterpiece of musical power, but it has a place in the wildwood orchestra, and would certainly be missed by anyone who has learned to know it. The usual call of the towhee is a group of about two syllables, which has suggested its name, for it resembles the word "towhee." The singing of the towhee consists of short series of notes suggesting the words "Ain't I pretty?" repeated with monotonous persistence from some low situation. The ending of the performance is a rattling trill, uttered with rising inflection and slurred in its hurried execution. The song is very easily identified by close attention on the listener's part.

The mountain song sparrow is one of our masters of song. It is a hardy little creature, being among the earliest to arrive from the south in the spring, and one of the first to open the vernal season of song. By the time our Station work begins, the high tide of sparrow music has spent its force, and all that remains for us is the slowly subsiding ebb. Our song sparrow, though, is one of the few songsters that can utter its cheerful roundelay at almost any season. The males are generally in song until they take their departure in the fall, and at any time one of them is likely to give a gentle, tuneful recital.

The song sparrow is famed for its varied repertoire in musical performance. The singing of any particular songster is much the same to ordinary listeners, but with no great degree of discrimination it can be perceived that a number of different songs make up a day's program of this little virtuoso. The same song may be given an indefinite number of times, when the songster will vary the arrangement so strikingly that the result will be a different song, which is repeated at impulse. Thus from time to time each song sparrow shows himself to be a master of eight to ten songs, each so unlike the others that it will pass for a different song. Generally the song begins with several distinct notes of equal value and tone; then there follows a series of hurried, blending syllables, ending with a cadenza of tuneful spirit.

In our account of the bird music of this region, we must not forget our junco, not because of its leadership in song, but because its music is a part of the later springtime which we enjoy in the early days of our Station season. Furthermore, the singing of the junco is so similar to that of the familiar chipping sparrow, that it is worth while to mention it that we may give the former its due share of credit for the rattling trills that we hear so frequently in the woods. The song of the junco is louder and sharper than that of the chipping sparrow, though like that of the latter, it is a series of monotonous chirps. It is usually uttered from one of the taller trees, preferably one apart in the sunshine or in the margin of the woodland.

In most portions of the Flathead region the singing of the western vesper sparrow is a noticeable feature. You remember it is the song of this sparrow about which John Burroughs wrote so charmingly. Someone has described the performance of the vesper sparrow as that of the song sparrow reversed, for it begins with the candenza, and ends with the two, three, or four accented notes. At the southern end of Flathead lake the western vesper sparrow is prominently abundant, and if it should chance to be your fate, as it once was mine, to spend a Saturday and Sunday at Polson waiting for the steamer, you will have ample opportunity to become acquainted with the musical powers of this gifted songster.

What limit shall we place to our definition of bird music? As we sit in the Station grounds, we hear overhead and about us the sibilant calls of the pine siskins, as they sport from treetop to tree in their social movements. It is music to the ears of the bird lover, at least, if it will not pass muster among the classic performances of the thrushes, tanagers, and grosbeaks. The pine siskin has no song, but its calls fill a large place in the avian chorus hereabout. One of its calls is a plaintiff "pee pee," the same as that uttered by the goldfinch as it swings in its billowy flight in the sunshine of late summer.

When we brave the tangle of the thick arbor-vitae swamps that crowd some portions of the banks of our splashing streams, we may hear the singing of the winter wren. Indeed, we may hear it on the banks of the Swan river, within fifty yards of the south end of the bridge near us. It is a peculiar song, but it is real music, a gush of hurried, spirited semi-demi-quavers, every note of which is emphasized by a movement of the tail of the nervous little performer. On the rocky ridges of the "Big Burn" east of the Station, the western house wren sings its roundelays, with which you are doubtless rather familiar. In the swamps at the head of Swan lake, we have the tule wren, the western representative of the long-billed marsh wren. The singing of the three foregoing species has a dcided generic resemblance, but the performance of each is characteristic and worthy of special note in an extended study of Flathead bird music.

There are many voices which enter into the composite product of bird music of this region, that can not have even a passing mention in a paper of this length. One of our most common songsters, the olive-backed thrush, has not been noticed because of our inability to describe its singing in any adequate terms. It is not a fine song, and is in no wise worthy of comparison with that of its eastern relative the wood thrush, but during our sojourn at the Station we hear it in numbers, and should cultivate an ear for it. In the latter summer the evening grosbeak calls with its loud chick-like chirp as it passes among the treetops in its daily activities. Among the evergreens of the rock ledges we can identify the grasshopper-like chirps of the kinglets, and in the lower woods the long-tailed chickadee has an occasional word to say. Nuthatch and creeper visit the Station grounds and announce their persence by their feeble calls. The swallows twitter a-wing near our boarding-house. Our enumeration of the bird-voices must close. Let us remember the words of the Great Teacher "He that hath an ear, let him hear," and though our present application of the saying may somewhat pervert its meaning, let us cultivate the faculty of hearing Nature's voice through the calls and songs of the children of the air.

Plankton Studies and Their Utility.

Maurice Ricker.

This production is intended to give the students at the Station an insight into the work the University is attempting to do on the plant and animal life of the lakes, streams and ponds in this part of the state. Still better would be a few days spent in the field and laboratory with the workers.

I may say in passing that none of the activities of the Station workers appear quite so mysterious to the uninitiated as does the plankton collecting. People expect to find an occasional crank pursuing butterflies with a net. The gathering of bird-skins and even nests and eggs by the enthusiastic collector can be accounted for, because they have seen such things displayed in museums. The same might be said of the work of the botanists, for people have been accustomed to herb-gatherers and their pressed flowers since time began. The geologist, with his interest in all kinds of rocks, is regarded always as a prospector. But what shall they think of the men who labor for hours, often in the darkness of night, and even in storms; rowing a boat for miles over rough seas, or wading dangerous swamps, just to pump water through a little silk net, the contents of which the collector carefully empties into a small bottle. They watch him put in a carefully measured preservative and chuckle over his catch of objects which are all but invisible. Thereafter the term "bug-house people" takes on a new significance.

Could they know the months of labor spent in studying these forms, dissecting out and drawing parts too small to be seen except under the compound microscope; the poring over drawings, and the tedious translation of works in other language ;then they surely would be convinced that the student was the victim of no trifling mental aberration.

At a risk of becoming tedious and commonplace, I must begin by recalling a few facts well known to many of you. July 1, 1738, Charles Darwin opened a note-book for the purpose of recording facts bearing on the transmutation of species. Fifteen months later he happened to read, for amusement "Malthus on Population."

In February, 1858, Wallace lay in a chill, and while thinking over the positive checks, disease, war, famine, and so forth; as discussed in the essays of Malthus, he conceived the idea that those who survive these checks to population must be the stronger ones. In two days it was on its way around the world in a letter to Darwin. Darwin had written 240 pages on the same theory some fourteen years previously, but the essay had never been published.

I need not tell you how this doctrine has revolutionized the thought of the century, and what an impetus it gave to the most minute study of every living plant and animal. Every creature became a big interrogation point. The question was no longer, how does it look, so that we may classify it and place it in its pigeon-hole and give it a long name. The plant or animal became a much more interesting problem. Men began to look beneath the exterior appearances, to speculate as to the cause of its existence, and to trace its relationship with the plants and animals about it. Every plant or animal, however insignificant, became a link in a series of ever branching chains.

Let us recall the story of the man who began to study yeast plants some years ago. He took up that interesting old problem of how life began—whether it arose spontaneously, or whether like begets like. So he worked for years over his glass tubes, with and without stoppers, with long, finely-drawn-out, bent necks, or with no necks at all, their contents variously treated.

Had skeptical friends remonstrated with him for wasting his life over such trifles that taxed the highest powers of his microscope—and no doubt they did—I can fancy his reply, insisting that they go on with their important matters of life. There were balls to be attended, politics to be discussed, goods to be bought and sold, fashions to be studied. Paris is such a busy place. And so they took up the weighty things of life, while Pasteur laid the foundation for the science of bacteriology. This science in twenty years has robbed the rusty nail of its terror, shown the way towards the ultimate solution of the problems of diagnosis and possibly the cure of all diseases caused by micro-organisms. To-day Pasteur's picture hangs in nearly every hospital and physician's office in the world.

We could supply an abundance of illustrations showing how men in following pure science have laid the foundations for future great works. Seldom does a man take such a prominent position as discoverer and yet live to put his investigations to some practical use. Read of the work of Young and Fresnel a hundred years ago, on light. They were unread then. Franklin and the ladies and gentlemen of the French court toyed with electricity a hundred years before it was practically in use. Oersted demonstrated electro-magnetic action, and yet failed to produce a motor. Davy separated metals nearly a hundred years before their practical use. These men builded for the future, and we enjoy the heritage they left us.

There is a three-fold reason for the immediate study of the microscopic life of these waters.

Firstly—There remains much to be worked out relative to the place and importance in nature of these animals and plants; and the knowledge of them is essential in order that the sum of human knowledge regarding the inhabitants of the earth may be complete.

Secondly—These plants and animals have a wonderful economic importance little guessed by the layman. This will be brought out later under the subjects: (1) food for the higher forms, and (2) their work as scavengers.

Thirdly—The work must be done at once, before man shall have cut down the forests, clogged the waters with saw-dust and much worse sewage. In fact before man shall have so changed the face of nature that a scientist seeking for some primitive conditions where life can be studied in its natural balance, would seek in vain.

If I am able to make but one point to-day let it be that this Station offers the rarest opportunity for this kind of investigation. This region should be studied in such a way that the work done will be valuable reference when compared with changed conditions which are sure to come later.

All water life is divided into two great classes by no hard and fast lines. These are littoral and pelagic. The former has to do with life on or near the shores. The latter deals mostly with the floating life of the waters, and it is included in our plankton studies. The term plankton is applied to the plant and animal life that moves with the currents. Floating algae and such minute swimmers as the microscopic crustacea would be included, while fish and other free swimmers would be excluded. It is an occasion of surprise to some to find that the quantity of such matter in any large body of water is so great that the fixed plants along the shore, and the animals they harbor, are comparatively insignificant in a consideration of the total life.

The number of individuals in a lake like the Flathead is beyond comprehension, and the number of separate species is large. The quantity of life if collected in one mass would weigh thousands of tons.

We know that the total amount varies greatly from season to season, and it will be soon shown that there is reason to believe that there is quite a range of variation in the relative numbers of organism from year to year.

We are learning something of their daily movements in summer. To undertake the studies of quantity and composition requires additional means of transportation, apparatus time, and literature, and an infinite supply of patience. Time and patience can not be purchased in the markets, so the plankton student must bring these with him.

If you care to make the trip go with me in the Missoula and we will push over to Station B. This location will be plain enough to you if you take the bearings. Station B, is at the crossing of two imaginary lines drawn one from the point of the delta to the club house, and one from the rocky point in the bay, down the middle of the bay. (See Plate XLVIII). The other stations are located by a similar method. From soundings we find we have eighty feet of water. The temperature at the surface and at various depths, the time of day, the nature of sky and water are recorded. The Kofaid net of fine bolting silk is then carefully adjusted over the side of the boat, and the pump and hose made ready to use.

Pumpings are now made at the surface by holding the end of the hose from one to three inches from the top. This catch is put into carefully labelled bottles with numbers corresponding to those in a note-book, where the data before mentioned are kept. The plankton is preserved in a one per cent solution of formaldehyde. Other pumpings are made at three, seven, fifteen, twenty-five, fifty feet, and to the bottom, and the collections properly labelled. We then proceed to similar operations at the other stations.

We have endeavored to make daily collections the past two years while the station is open. You can readily see how valuable would be one year's continuous work, daily if possible, to discover seasonal changes.

Let us now go to the laboratory and examine the collection. We usually tow the net over the surface, and have taken very many bottles of this material. We will examine an average sample from a representative bottle, under the compound microscope. You will be delighted with the beautiful forms, the delicate desmids and diatoms, and those wonderful creatures classed broadly as microscopic crustaceans, and more properly as **entomostraca.** Note the beauty and variety of this life, and then I doubt not you will be seized with a desire to know their names and uncover their secrets. We would soon have you dissecting out the fifth feet and noting other characters, for we must classify whether we like it or not. Then we are ready to count forms, study movements, or go more deeply into their reason for being. You could not long question the motives of the enthusiastic student, and you would probably soon find yourself as deeply into the problem. "You have but to look at life and you will find it interesting, in whatever form, or from whatever standpoint you view it."

For the second reason I gave a hint as to the economic interest. We may be charged with magnifying this side of the question, since it is from the ceonomic point that we solicit aid in carrying on the work. But the United States Fish Commission would not have been organized in the interests of pure science. It is supposed to deal with problems that affect the food and labor of millions. There were two reasons given for its creation. (1) "An investigation into the cause of the decrease of the seacoast fishes and those of rivers and lakes, with suggestions as to the best methods of restoring the same; and (2) active measures looking toward the propagation and multiplication of the useful food fishes, either by restocking the depleted waters, or by introducing desirable species into new localities."

Allow me to quote from Prof. Reighard on the subject. "In this country the fisherman continues to fish in any locality until it becomes unprofitable. He then moves his base of operations to new waters, until these in turn have been exhausted. He is apt to look upon each new body of water as inexhaustible, and rarely has occasion to ask himself whether it is possible to determine in advance, the number of fish that he may annually take from the water without depleting it.

"On the other hand the fish culturist is likely to plant the fry in waters that are quite unsuited to them; or to plant them in water far to the excess of what the water can support. The fisherman proceeds as a farmer might who imagined that he could continually reap without either sowing or fertilizing; while the fish culturist proceeds often as if convinced that seeds might grow on barren soil, or that two seeds might be made to grow in place of one."

Now, since the whole structure of animal life rests ultimately upon vegetable life, large or small, and since most fish feed upon food produced in the water, we must readily see the interdependence between the larger and the smaller animals and plants. The food of our game fishes, as you know is live animals. The food of these animals is no doubt smaller living creatures; and so you may follow the series down to the smallest animal, one who can find no smaller victim. Among this lower class are the copepoda. Their food is largely vegetable, and they are no doubt an important element in the survival of the game fish during that critical period of youth. Together with aquatic insects they make up the food of the small fry of the game fishes. In the ocean they form the food of the whale. They are a connecting link in animal life. No man can foresee what would result, and few would believe if told,—if these insignificant animals should cease to be.

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No. 18.
BIOLOGICAL SERIES No. 6.

ADDITIONAL NOTES

TO

Summer Birds of Flathead Lake,

WITH SPECIAL REFERENCE TO

SWAN LAKE

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BY

PERLEY MILTON SILLOWAY,

Principal Fergus County Free High School, Member American Ornithologists Union.
Author of "Some Common Birds," "Summer Birds of Flathead Lake," Etc.

WITH INTRODUCTION BY MORTON J. ELROD.

Prepared at the University of Montana Biological Station, Bigfork, Mont.,
Under Direction of Morton John Elrod.

University of Montana, Missoula, Montana, U. S. A.
1903.

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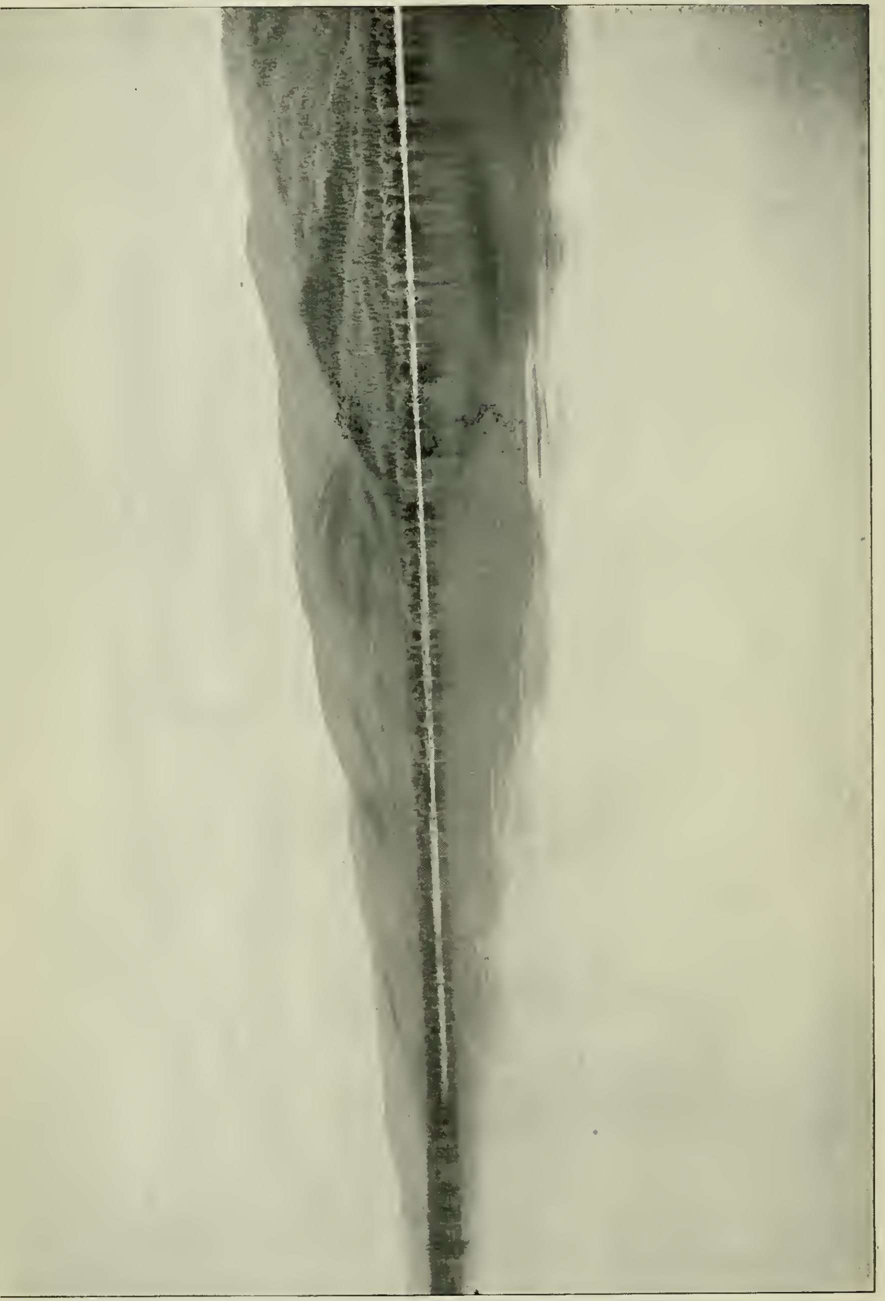

Upper end of Swan Lake, showing the swampy shore and wooded slopes of Mission Range. Photo in July by M. J. Elrod. The view is S. W.

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Introduction.

The notes presented in this bulletin, when added to the bulletin "Summer Birds of Flathead Lake," University of Montana Biological Series No. 1, include the work on ornithology during the summers of 1900, 1901, 1902 and 1903. Three seasons having been spent in the Mission Mountains, on the Flathead Indian Reservation, and along the shores of Flathead lake, it was thought best to extend the observations in the summer of 1903. Prin. Silloway was therefore recommended to spend a portion of the time in the vicinity of Swan lake.

This lake is a beautiful sheet of water, cradled between two ranges of mountains, with wooded slopes to the water's edge. It is primitively wild, with miles of woodland, interspersed occasionally with open glades.

Only a few hardy pioneers have entered the region. The birds have thus not been molested by man, and a visit to the region gave opportunity for study not heretofore made.

The illustrations here given are as faithful a portrayal of the region about Swan lake as can be made with the camera. Plate LIII shows the region to the southeast, with the Mission range in the background. The mountain slopes to the low summits are covered with a dense forest. Bordering the lake may be seen a fringe of willows, back of which are the cottonwoods and alders, and lastly the conifers. A large area bordering the water is swampy, shown in Plates LIV and LV. It is exceedingly difficult to get around in this region. Plate LVI shows the location of the lake with regard to the mountains, while Plate LVII shows a large portion of the wooded valley south of and above the lake. With the exception of a section of country including the lower portion of the lake as shown in Plate LV all of the country shown in the photographs is in the Lewis and Clarke forest reserve.

The notes here presented by Prin. Silloway contain several important features worthy of special mention. One point is the calamity that often befalls the old birds or the young. Another is the fact that birds occupy unfinished nests, which contain eggs. This latter may be due to the laziness or shiftlessness on the part of the mother, or to her inexperience, which prevents rapid working, or to the destruction of a first nest. The finding of a nest of the Willow thrush, which ordinarily builds close to the ground, six and one-half feet up in a tree, will be of interest to students of animal intelligence, as illustrating the change of habit due to environment. The region overflows annually. Irregular habits of nidification were also found in the cedar waxwing. Indeed, the notes so carefully prepared show quite plainly great individuality in the construction of the nests.

Since Bulletin Biological Series No. 1, Summer Birds of Flathead Lake, is out of print it is considered advisable to print a list of the summer birds thus far discovered, which is appended. This list therefore includes all the summer birds which have been observed about Flathead lake, numbering 137.

MORTON J. ELROD.

Missoula, Mont., Sept. 19, 1903.

Further Notes on the Summer Birds of Flathead Lake.

The following notes are based upon observations made from May 30 to July 30, 1902. The first three weeks of June were spent at the head of Swan lake; the remainder of the time was given to observation in the immediate vicinity of the Biological Station. As a supplement to the notes made during the seasons of 1900 and 1901, which were reported in the bulletin entitled "The Summer Birds of Flathead Lake," issued under the direction of the University of Montana Biological Station, these further notes are deemed worthy of publication. Several important species, overlooked in the previous seasons, were noted in 1902; and as a complete record of our observations for the region is desirable, the notes herein given will serve to fill out somewhat that which was lacking in the larger bulletin. As previously stated, no attempt has been made to furnish a complete list of the birds of the Flathead region, but simply to report such observations as were made by our party during the collecting season; hence no authorities have been cited. It is merely intended to furnish a record of personal work that may be helpful to other observers.

SWAN LAKE.

Among the many little lakes which lend interest and beauty to the Mission, Swan, and other ranges of our Montana mountains, Swan lake is worthy of consideration because of many delightful features. It is an expansion of Swan river, or the Big Fork, the outlet of the lake into the river being about eight miles overland from the Biological Station, in a direction somewhat south of east. A very poor road, generally overflowed during the time of high water in the spring, but tolerably passable at other times, leads from the Station to the foot of the lake. Another road, generally in ordinary condition, follows a course around the bend of Swan river to the northward, thus furnishing access to the lake at all times, the distance over this road being about fifteen miles.

In its origin the lake bed is probably the result of glacial action, whereby in remote ages an irregular furrow was ploughed by the moving ice-mass. The situation is between the northern end of the Mission range and the southern end of the Swan range, and nearly parallel to the eastern shore of Flathead lake. From the tops of the Mission summits between the two lakes, both can be easily seen, the separating crests being not more than five or six miles in breadth.

Swan lake is said to be about twelve miles in length, and the average width is at least half a mile. The contour of the lake is formed by several successive slightly cresentic bays or enlargements. At its head it opens out into a nearly circular area about two miles in diameter, above which lies a large submerged region in the spring, though later it becomes a meadow covered with a rank growth of coarse grass. The western side of the lake is bounded by gradual slopes of the dwindling Mission mountains, presenting vast areas of evergreen forest, part of which is in the domain of the Lewis and Clarke forest reserve. On the eastern side of the lake are the rugged, fire-swept, or rocky heights of the Swan range, rising quite abruptly from the water's edge.

The swampy area at the head of Swan lake was the scene of most of our activities during the first three weeks of June. At that time it was covered with dead water from two to four feet in depth most of the new growth not having yet appeared above the water. Here and there were patches of old reeds, browned and tangled, with a few green reeds struggling toward the light. In this swamp we found holboell's grebe in a small colony. American golden-eyes were leading forth their broods for their first practice on the water; a few yellow-headed blackbirds were hoarsely piping in the reeds. Overhead a pair of bald-headed eagles, the male a magnificent specimen with regal white head and snowy tail, soared or flapped lazily from range to range, seeming not to care to molest the industrious ospreys that used this most convenient fishing-ground. Now and then a sora could be startled from its haunts in the reeds, or a marsh wren would amuse us with its squeaky songs. Mallards were regularly feeding in the grass; while occasionally the booming of the American bittern announced its presence in the bog.

The forested margin of the lake was populous with birds. In the twilight depths the varied thrush flitted here and there; frequently a black-headed jay uttered his harsh warning, and watched the observer from a treetop. Pheasants, the gray ruffed grouse, were nesting commonly in the neighborhood. About our cabin Cassin's purple finch was a regular visitor. Indeed, it is certain that no other portion of the Flathead lake region is tenanted by a greater number of species than the swampy area and the immediate neighborhood of Swan lake, and to make special mention of any inhabitants of the locality would serve only to mislead the reader regarding the occurrence of others.

Oological Notes.

Of several species, quite common throughout the Flathead region, no nests were met with in the seasons of 1900 and 1901. Notes made concerning such as were found nesting in 1902 may be of interest, though little new or unusual was observed in the nidification thus described.

A nest of the western robin, **Merula migratoria propinqua**, was found on May 31, at Polson. It was in a low crotch of a haw tree, and contained three eggs. Thinking that the set was incomplete, I visited the nest on the following morning to note progress, when I found only two eggs in the nest. It was evident that some marauder had despoiled the home of part of its contents. I was unable to follow the fate of the nest, but it is likely that on a future occasion, when the owner returned to her nest after an outing, she found it empty. Last season I noted a similar occurrence in the history of a nest of Wright's flycatcher, **Empidonax wrightii.** Each successive day the set showed a decrease of one egg, until finally only the empty nest remained. It would be interesting to know the particular despoiler of each of these wildwood homes.

In view of the extended notes given concerning the nidification of the olive-backed thrush, **Turdus ustulatus swainsonii**, in the larger bulletin, it may seem superfluous to add anything of like nature in these pages. However, the following may not be out of place. A deserted nest of olive-backed thrush was found on July 6, containing two eggs. The site was an upright crotch of a small fir, perhaps the lowest in my observation, the brim of the nest being not more than three feet from the ground.

Deserted nests of this thrush are chanced upon quite frequently. One fell under my notice on July 9, on the Helena club grounds near the road. It was in an upright crotch of a dead oblique fir, about seven feet from the ground. It was a very bulky nest, the walls averaging one and one-fourth inches in thickness. They were made of coarse dried grass, lichen, skeleton leaves, and punky material, the unfinished interior being mainly of skeleton leaves. This nest contained four eggs, rather advanced in incubation.

In several instances I have observed the olive-backed thrush sitting in the unfinished, empty nest. On July 6, I noticed a female sitting in a nest of which the foundation was scarcely laid. Apparently she was not working on the nest, shaping it to her form, but sitting quietly as if incubating. On July 19, I inspected this nest, and then it contained three eggs advanced in incubation. Once before this season I noticed a female sitting in her unfinished nest. It is worth mentioning that on both these occasions the day was showery, and the weather may have influenced the bird in its action.

As in each of the two preceding seasons, one nest of the willow thrush, **Turdus fuscescens salicicola**, was found, and the different site it occupied makes it worthy of mention. It was in the swampy area west of the Station grounds, bordering the harbor. Instead of being situated near the ground, it was six and one-half feet above, in an upright crotch of an oblique thorny sapling. The nest was typical of the willow thrush in construction, but the site was so unusual in my experience that I collected the owner for complete identification. It was a bulky structure, made of coarse weed-stems, pine needles, and bark, lined with fine black rootlets. A large piece of green leaf, which had probably fallen into the nest, had been incorporated into the lining. The cavity averaged two and three-fourths inches in diameter, two inches deep. The eggs were unspotted, of the greenish-blue color characteristic of this species.

One nest of the long-tailed chickadee, **Parus atricapillus septentrionalis,** was found. It was at the head of Swan lake, on June 6, at which date the eggs were about ready to hatch. The site was an old cavity made by a small woodpecker or the owner, in an old decayed birch stump in the swampy margin of the lake. The nest was a soft bed of rabbit fur. There were seven eggs in the nest.

On July 1, a nest of Parkman's wren, **Troglodytes aedon parkmanii,** was examined. It was on the tract known as the "Big Burn," on the Mission slopes southeast of the Station, in a cavity made by a woodpecker in a decayed stump. The nest was made of dead twigs for a foundation, weed-fibers, soft feathers, and pieces of sloughed snake skin. There were two fresh eggs in this nest.

The catbird, **Galeoscoptes carolinensis,** nests very commonly in the region about Daphnia Pond. On July 7, I found my first nest of this species containing five eggs. One of these was infertile, and the others were quite advanced in incubation. The catbird prolongs its nesting season, though later sets of eggs contain less than the regular complement of four of earlier nesting. On July 16, we noted a nest containing three eggs, and on July 22 another nest was found with three eggs. All of these nests were in the low buckbrush growing so plentifully on the ridges near the Station.

A nest of the cedar waxwing, **Ampelis cedrorum,** seemed to indicate irregular habits of nidification of this species. The nest was noticed on June 27. It was situated in a fir in the edge of the Station grounds, near the top of the tree and about twelve feet from the ground. It was made on horizontal branches, against the main stem, from which site it was removed when first noticed, examined, and replaced to wait for later examination. It then contained three eggs. On June 30, it contained four eggs. On July 1, when the eggs were further examined, three of them were incubated very noticeably beyond the fourth, a condition showing that the eggs were not deposited on successive days, or that the three eggs had been incubated several days longer than the fourth.

The western vesper sparrow, **Poocaetes gramineus confinis,** nests abnudantly near the shore of Flathead lake. In the meadow opposite to the store at Polson, five nests were found, and another nest was noted just outside the fence, in the bushes bordering the lake. On May 31, a nest was taken from a depression at the base of a grass tuft. It was made of coarse dried grass and horsehair. Cavity two and three-eighths inches in diameter, depth one and one-half inches. The depression was on the shady and darkest side of the grass tuft. There were four eggs, fresh. The eggs of this sparrow are pale greenish-white, irregularly marked with spots of reddish-brown. On May 30, a nest of the western vesper sparrow was found in a depression at the base of a little bush, beside a path between the meadow and the lake. It contained three eggs, which were somewhat incubated. Another nest noted on May 31 with three eggs, on June 2, contained only two eggs. Another examined on June 2, contained one youngling just hatched, one egg breaking for the struggling occupant, and two eggs. Another nest noted on June 2, held four fresh eggs; another held four fresh eggs, and still another contained three eggs far advanced in incubation. All of these nests were made after a common plan of structure, and were on the darkest side of the tufts under which they were placed, a characteristic not usually noticeable in the sites of most of the ground-nesting species, and indeed not generally characteristic of the vesper sparrow.

Brewer's blackbird, **Scoleophagus cyanocephalus,** was commonly nesting in the low bushes near the lake shore at Polson. On May 31, a nest of this species was taken from a bush in a clump. The site was twelve inches from the ground, among upright stems. The nest was made of coarse weed-stems and twigs, with muddy material in the walls, and a bedding of horsehair. The cavity was three and three-fourths inches across, and two and three-fourths inches deep. This nest contained six eggs, partially incubated. A second nest contained three eggs of the owner and one of the cowbird. The eggs of Brewer's blackbird are dark greenish-white, variously marked with blotches of dark brown.

At Selish, a nest of the western meadowlark, **Sturnella magna neglecta,** was observed on the hillside back of the hotel. It was made in typical manner, of coarse dried grass, in a tuft of tangled dead and green grass, well arched at the top. There were five eggs, partially incubated. They were very handsomely marked, having large, bold blotches of reddish brown on a snowy background.

Traill's flycatcher, **Empidonax traillii,** has been mentioned as nesting throughout this region. On July 8, a nest of this flycatcher was found in a small fir in the edge of the Station grounds, within arm's reach of a path leading down into the swampy area. It was placed upright on horizontal twigs beside the main stem, six feet from the ground. When first noticed it contained three younglings about ready to leave the nest. In structure the nest is much like that of the yellow warbler, **Dendroica aestiva,** or that of Wright's flycatcher, **Empidonax wrightii,** being made of strippings of weed-stems, grass stems, and bits of gossamer. On July 6, after a cold rain of a week's duration, a nest of Traill's flycatcher was noticed containing three young birds about half fledged, dead, doubtless from exposure.

A nest of the western wood pewee, **Contopus richardsonii,** was noticed near the Station on July 8. It was in an aspen on the lake shore, saddled upon a dead branch at a fork about three feet from the main stem, and about fifteen feet from the water below. In attempting to examine it, I accidentally spilled the four eggs, and the nest dropped into the water and was almost immediately disintegrated. The eggs were found to be far advanced in incubation. Another nest of this species was noted on July 17, in a large fir tree on the shore of the lake near the Station. It was about fifteen feet from the ground, near the extremity of a large dead horizontal branch, the site being at least ten feet from the trunk of the tree. As in the former instance, the nest was made upon a horizontal fork. Fearing that the accident in the former case might repeat itself, we did not attefpt to examine this nest, and left the female sitting contentedly upon her breezy home. The eggs of the western wood pewee are creamy yellowish-brown, blotched irregularly with reddish-brown.

The western nighthawk, **Chordeiles virginianus henryi**, nests abundantly on the rocky ridges near the Station. A set of two eggs of this nighthawk was found June 26, on the rocky ridge west of the road leading to Holt. The sitting bird was startled within three feet of me as I ascended the rock. She flitted painfully away for about twenty feet, and sat fluttering for several minutes; then she flutered over the edge of the cliff and disappeared. The eggs were on a portion of bare rock surrounded by brown moss, the bare spot being not more than three inches square. The eggs were advanced in incubation. They are a dark stone gray, variously marked with spots and blotches of dark brown. On July 1, I chanced upon a sitting nighthawk on the rocks east of Daphnia Pond. Upon being flushed, she flew away low and heavily. Only one egg was found, far advanced in incubation, and I fancied that the parent bird had carried away an egg or a young recently hatched. The egg was on the bare rock or earth which scantily covered the rock, though a few small sprouts were growing near. On July 19, a set of two fresh eggs was found on these rocks.

Several nests of the gray ruffed grouse, **Bonasa umbellus umbelloides,** were examined. One found on June 7, at the head of Swan lake, was made about eight feet from a trail used frequently by trappers. It was under the upturned end of a fallen log, in warm exposure, made of dead leaves in a depression, with half a dozen soft feathers. The depression measured seven inches across at the top, and was two and one-half inches deep. There were ten eggs, partialy incubated. They are a light reddish-cream color, having few faint indistinct specks of reddish-brown. On June 15, a nest of this grouse was noted with six eggs. It was at the base of a small fir, made as before described, and like the other, it was near a trail and not closely concealed. On June 20, the nest was empty, the eggs having evidently hatched, and the place was deserted. Another nest of the ruffed grouse was found on June 16, in the edge of a small clearing on Swan lake. This nest was under the edge of a fallen log, among surrounding tangled weeds that most effectually concealed the nest. It held seven eggs which were thought to be about ready to hatch.

A small colony of Holboell's grebe, **Colymbus holboellii,** consisting of at least five pairs, was found nesting at the head of Swan lake. The first nest was found on June 4, among tall dead reeds. It was made of black decaying material, with some green reeds intermingled. The mass floated about four inches above water. The nest was in the edge of a clump of reeds, about which there was clear water all around. There were five eggs, loosely covered with material similar to that of the nest. The eggs were partially incubated, and had acquired the browned, baked appearance peculiar to eggs of the grebes after lying some time in the nest. On June 7, a second nest of this grebe was found, situated in bushes on overflowed ground. It was made as usual of decaying material, with which some green reeds in short pieces were intermingled. This nest was founded on coarse dead twigs, probably brought up from the ground below. These eggs were also covered with material like that in the nest, the four eggs being somewhat advanced in incubation. Nest No. 3 was noted on June 17, with five eggs, uncovered, and quite fresh. They were of a pale greenish-white color, not having changed to the appearance described in a foregoing account. This nest was made as usual, anchored in the edge of old reeds. It is worth while to state that on June 12, this nest held two eggs, on June 14, three, and June 17, five. A fourth nest was noted June 17, with three eggs about half incubated. On June 18, another nest of Holboell's grebe was examined, which was in the willow bushes in the edge of the overflow area. It was made on depressed branches, a large strong nest, twenty-four inches across at the surface of the water, rising four inches above the water, with a cavity seven and one-half inches across, one and one-half inches deep. This nest was made as the others, of old reeds with some new material on top. There were four eggs, incubation far advanced. On June 20, a set of three eggs was found in a large nest anchored in the edge of a small clump of reeds, the eggs being partially incubated. The last nest of this series was examined June 20, and contained four fresh eggs, It was a large mass of dried decaying material anchored among thick reeds, with two opposite approaches through the reeds to open water. The eggs were not covered, but being fresh were of the bluish-white tinge.

On Juiy 4, 1903, a nest of the Louisiana tanager was found in a tall fir tree in front of the Biological Station building. The birds were observed to frequent the place, and by close watching the female was seen to take her place upon the nest. It was about twenty-five feet from the ground, on a dwarf branch among others which were the lowest bearing vegetation. The site was a horizontal fork, and the nest was held in place by surrounding twigs. It was made outwardly of coarse forky twigs, the walls being chiefly made of fine rootlets, and there was a lining of horsehair. The cavity was two and three-fourths inches in diameter, and one and one-half inches deep. When the nest was collected the female was sitting, and she remained on the nest until I had nearly reached the branch. The tuft of twigs in which the nest was made was about four feet from the main stem. There were four eggs, about one-half incubated. They are pale bluish green, with specks of blackish brown distributed sparsely over the surface. When removed from its site, the loose twigs in the outer part of the nest fell away like that part of a grosbeak's nest.

On July 15, a nest of Townsend's warbler, **Dendroica townsendi**, was found in a clump of small firs on a rocky ridge of the Helena club grounds. The site was unusually low, being only six feet from the ground in a small fir surrounded by larger ones. The nest could be seen only by a person pushing his way into the clump. It was made beside the main stem, situated like a chipping sparrow's nest, which it greatly resembled. It was made externally of coarse weed-stems and grasses, with a lining of fine grasses and horsehair. The cavity was two inches in diameter, and one and three-eighths inches deep. The nest contained five young which were nearly fledged, showing the black crown and yellow superciliary line, and wing-bands. All the young were infested with a parasitic grub, which had eaten a hole in the skull and neck; it appeared that the brain had been entirely destroyed by the wriggling occupants of the cavity, though the younglings were apparently enjoying life and were eagerly stretching forth their mouths at the approach of the parents. The male seemed most active in bringing in supplies, and he was collected with little difficulty. The female was shyer, and only by considerable waiting and watching was the collector able to secure her.

On July 6, 1903, a nest of the ruby-crowned kinglet, **Regulus calendula**, was collected, with both parent birds. This nest was along a road through the Helena club grounds. It was situated about fifteen feet from the ground, near the extremity of a branch of a medium-sized fir tree. The site was six feet from the main stem. The nest was partially saddled on an oblique twig on the under side of the branch, and was also somewhat pendent from several smaller twigs about which the walls were woven. The nest was four inches in diameter externally, and three inches deep. The opening was two and one-fourth inches across, and the cavity was one and seven-eighths inches deep. The nest walls were made of dark green lichens common in the tamarack forest, deer hair, gossamer, and shreds of bark. The lining was made of hair, soft downy feathers, and lichen. There were eight young in the nest, ready to leave in two or three days at most.

Notes on New Birds.

167. Ruddy Duck, **Erismatura jamaicensis** (Gmel.)

This handsome little duck was met with in the summer of 1901, on a small pot-hole on the Flathead reservation. The watery area was about an acre in extent, margined by a thick growth of grass. As we passed it somewhat hurriedly, we noticed several ducks on the water. Loitering behind the others, I made a circuit of the pond, and at one place I came upon a wounded duck crouching in the grass, almost under my feet. Before I could capture it, the duck revived and swam out into the deeper water. However, I could not fail to recognize the reddish-chestnut of the back, and the black of the head, nor the little tail left so jauntily erect. Indeed, I was stooping to pick up the duck when it glided away from my reach. It is likely that several pairs of this duck were nesting on the little pond where they were seen.

206. Sandhill Crane, **Grus mexicana** (Mull.)

The sandhill crane was observed in both the seasons of 1901 and 1902. In the former summer, on July 29, a pair of these cranes was observed standing on a stranded tree near the mouth of Flathead river. I tried to secure a specimen with the shotgun, but the great birds paid no attention to my No. 6 shot. These birds lingered near the mouth of the river for several days, but they were too wary to be taken. In 1902, when we were encamped at the head of Swan lake, July 26, a sandhill crane flew overhead, circling somewhat uneasily about the place, and finally alighted in the meadow, but was not thereafter observed.

221. American Coot, **Fulica americana** Gmel.

The American coot eluded our notice until the spring of 1902, when it was observed in the swamp at the head of Swan Lake. On the morning of June 6, two individuals were seen feeding, and as they paid little attention to our quiet movements in a skiff, we watched them for some time with considerable interest. Hoping that they might be nesting in the swamp, I refrained from taking a specimen at that time. However, they were not seen again, and there was no evidence of their nesting there. We were told by trappers in the neighborhood that the coots assembled in the swamp in the fall in hundreds.

225. American Avocet. **Recurvirostra americana.**

The American avocet was not noted in the Flathead region until 1903, when a single specimen was observed on August 11, at the mouth of Flathead river. It was feeding on the sand-bar in company with several Baird's sandpipers and some ring-billed gulls. An effort was made to secure it, but it flew away with a broken leg and we were unable to capture it. However, there can be no doubt regarding the indentification, as the species is well-known to me from previous observation.

357. Piegon Hawk, **Falco columbarius** Linn.

A fine specimen of pegion hawk was taken on the Station grounds on July 19. It flew into one of the trees soon after sunset, moving restlessly from one tree to another until my attention was directed to it. My first impression was that it was a sparrow hawk, but thinking best to secure it, I caught it by a lucky shot as it was leaving the grounds. It presented the following measurements: length, 11.15 inches; wing, 7.80 inches; tarsur, 1.30 inches; culmen to cere, .50 inch; tail, 5 inches; middle toe to claw, 1.15 inches; extent of wings, 23 inches. Iris, brown; cere, tarsi, and feet, yellow; mandible, greenish-yellow basally, bluish horn at tip. The specimen proved to be a male, and was in splendid plumage in almost perfect coloration.

358. Richardson's Merlin, **Falco richardsonii** Ridg.

A male of this species was taken at the head of Swan lake on July 26. It was apparently a young of the year, as the rusty markings predominated in its plumage. The specimen presented the following approximate measurements: length, 12.50 inches; wing, 8.60 inches; tail, 5.75 inches; tarsi, 1.35 inches; culmen to cere, .55 inches; middle toe to claw, 1.32 inches.

379. Pygmy Owl, **Glaucidium gnoma** Wagl.

This interesting little owl occurs regularly throughout the wooded parts of the Flathead lake region, but it eluded our notice until 1902. During the protracted rains of the first week of July, we were kept generally indoors, but in an afternoon walk between showers, Mr. Ricker saw a specimen of this owl near the Station and described it very accurately to me. It was not until July 17, that it chanced under my observation, when three specimens were taken from a family which was taking an afternoon outing along the road through the woods south of the bridge at Bigfork. One of the owls was sitting in a small tamarack beside the road, almost within reach of passing teamsters. When it was shot, the others flew from perches nearby, and alighted in the largest trees not far away. They perched in each instance on horizontal branches close to the main trunk. When flushed, they uttered a faint shrill whistling call. One of the family, the female in charge of the youngsters, uttered a low cooing whistle, in low pitch.

It was reported to me that specimens of tne pygmy owl were at Kalispell. Mr. Ernest Bond also told me that this owl was frequently taken at the head of Swan lake. (It is also found at Missoula. M. J. E.)

497. Yellow-headed Blackbird. **Xanthocephalus xanthocephalus.**

This species was found sparingly in the swamp at the head of Swan lake, the first being noted June 7, when both males and females were seen. Thereafter specimens were seen every day that we visited the swamp, until June 21, during which time the males were in song. As far as I could observe, there were no nests in the swamp. No specimens were taken, as I did not wish to interfere with the nesting of this species by sacrificing the lives of any of the colony.

675a. Grinnell's Water-Thrush. **Seiurus noveboracensis notabilis.**

This water-thrush was heard regularly in the swampy woods at the head of Swan lake, singing cheerily from the tangled bushes, but it managed to elude capture until July 10, 1903, when it was still in song. It was also heard in the swamp-woods near the mouth of Swan river. There is no doubt that Grinnell's water-thrush breeds in suitable localities in the Flathead region.

725c. Western Marsh Wren. **Cistothorus palustris plesius** Ober.

A specimen of this wren was taken in the marsh at the head of Swan lake, July 26. It was singing vigorously, and near it an unfinished nest was found, the only evidence of its nesting.

763. Varied Thrush. **Ixoreus naevius** (Gmel.)

The varied thrush was found to be common at the head of Swan lake, where it flitted in the dark forest of the mountain-sides. An old nest was brought to me, containing fragments of shells easily indentifiable. The nest was made like one of the olive-backed thrush, outwardly of twigs and lichens, lined with soft whitish fibers. It is reported to nest very early. The trappers in the neighborhood, and the person who brought me the nest, asserted that this species is a winter resident as well in this region.

List of Birds.

List of the Summer Birds of Flathead lake, including those given in the former bulletin and those added by the present bulletin.

1. Colymbus holboellii. Holboel's Grebe. A small colony found breeding at the head of Swan lake, 1902.

2. Colymbus nigricollis californicus. American Eared Grebe. Young reared in Sinyaleamin lake, Missoin Mts., 1901. Also at Rost lake.

3. Urinator imber. Loon. Common, breeds.

4. Urinator lumme. Red-throated Loon. Specimens taken at Flathead lake and at Rost lake, 1901.

5. Larus occidentalis (?). Western Gull. One specimen, doubtfully identified, taken at the mouth of Flathead river.

6. Larus delawarensis. Ring-billed Gull. Common at Flathead lake.

7. Sterna forsteri. Forster's Tern. One specimen taken from a small flock, Aug. 23.

8. Merganser americanus. American Merganser. Noted regularly after Aug. 23, 1901.

9. Lophodytes cucullatus. Hooded Merganser. A female taken July 15, 1901, at Rost lake.

10. Anas boschas. Mallard. Common, breeds.

11. Nettion carolinensis. Green-winged Teal. Common after the middle of August.

12. Dafila acuta. Pintail. Common, breeds.

13. Aix sponsa. Wood Duck. A male young-of-the-year taken July 31, 1901, from a small flock.

14. Clangula clangula americana. American Golden-eye. The commonest of the breeding ducks of the region, seen on every little body of water.

15. Charionetta albeola. Buffle-head. Not common, breeds.

16. Erismatura jamaicensis. Ruddy Duck. Found breeding on the pot-holes of the reservation.

17. Branta canadensis. Canada Goose. Common, breeds.

18. Botaurus lentiginosus. American Bittern. Common, breeds.

19. Grus mexicana. Sandhill Crane. A pair seen July 29, 1901, at the mouth of Flathead river.

20. Porzana carolina. Sora. Common, breeds.

21. Fulica americana. American Coot. Seen only at the head of Swan lake early in June, 1902.

22. Phalaopus lobatus. Northern Phalarope. A specimen taken on Flathead lake August 27, 1900.

23. Gallinago delicata. Wilson's Snipe. Common after the middle of July.

24. Tringa bairdii. Baird's Sandpiper. Occurs regularly after the middle of August.

25. Calidris arenaria. Sanderling. Common toward the end of August.

26. Totanus melanoleucus. Greater Yellowlegs. Common.

27. Totanus flavipes. Yellow-legs. Common.

28. Helodromus solitarius. Solitary Sandpiper. Occurs regularly toward the end of July and thereafter.

29. Bartramia longicauda. Bartramian Sandpiper. Occurs locally, breeds.

30. Actitis macularia. Spotted Sandpiper. Abundant, breeds.

31. Numenius longirostris. Long-billed Curlew. Common, breeds.

32. Aegialitis vocifera. Killdeer. Common, breeds.

33. Colius virginianus. Bob-white. Introduced, increasing between Bigfork and Kalispell.

34. Dendragapus ogscurus richardsonii. Richardson's Grouse. Occurs in the mountains near the lake.

35. Dendragapus franklinii. Franklin's Grouse. Occurs in the higher mountains.

36. Bonasa umbellus umbelloides. Gray Ruffed Grouse. Abundant.

37. Pedioecetes phasianellus columbianus. Columbian Sharp-tailed Grouse. Abundant in the open prairie regions.

38. Zenaidura macroura. Mourning Dove. Occurs regularly, but not numerous, breeds.

39. Circus hudsonius. Marsh hawk. Common at the foot of Flathead lake.

40. Accipiter velox. Sharp-shinned Hawk. Common, breeds.

41. Accipiter cooperii. Cooper's Hawk. Not numerous, breeds.

42. Buteo borealis calurus. Western Red-tail. Not uncommon, breeds.

43. Archibuteo lagopus sancti-johannis. American Rough-legged Hawk. Seen frequently in flight high overhead.

44. Aquila chrysaetos. Golden Eagle. Common.

45. Haliaeetus leucocephalus. Bald Eagle. Several pairs living in this region.

46. Falco columbarius. Pigeon Hawk. A fine specimen taken July 19, 1902.

47. Falco richardsonii. Richardson's Merlin. A young of the year taken at Swan lake, July 26, 1902.

48. Falco sparverius deserticolus. Desert Sparrow Hawk. Abundant.

49. Pandion haliaetus carolinensis. American Osprey. Common, breeds.

50. Asio wilsonianus. Long-eared Owl. One specimen seen at Selish.

51. Megascops asio maxwelliae. Rocky Mountain Screech Owl. A specimen taken at Post creek, on the reservation.

52. Bubo virginianus subarcticus. Western Horned Owl. Common in the wooded districts.

53. Glaucidium gnoma. Pygmy Owl. Several specimens taken in 1902.

54. Ceryle alcyon. Belted Kingfisher. Abundant.

55. Drybates villosus hyloscopus. Cabanis's Woodpecker. Common.

56. Dryobates pubescens oreoecus. Batchelder's Woodpecker. Common.

57. Picoides arcticus. Arctic Three-toed Woodpecker. Not uncommon.

58. Picoides americanus dorsalis. Alpine Three-toed Woodpecker. Not uncommon.

59. Sphyrapcus varius nuchalis. Red-naped Sapsucker. Common, breeds.

60. Ceophloeus pileatus. Pileated Woodpecker. Common in the heavy woodlands.

61. Melanerpes torquatus. Lewis's Woodpecker. Common.

62. Colaptes cafer. Red-shafted Flicker. Abundant.

63. Chordeiles virginianus henryi. Western Nighthawk. Abundant.

64. Selasphorus rufus. Rufous Hummingbird. Common, breeds.

65. Stellula calliope. Calliope Hummingbird. Not uncommon.

66. Tyrannus tyrannus. Kingbird. Abundant, breeds.

67. Tyrannus verticalis. Arkansas Kingbird. Common, locally, breeds.

68. Contopus borealis. Olive-sided flycatcher. Not uncommon on the mountain slopes.

69. Contopus richardsonii. Western Wood Pewee. Common.

70. Empidonax traillii. Traill's Flycatcher. Common.

71. Empidonax wrightii. Wright's Flycatcher. Common.

72. Otocoris alpestris arenicola. Desert Horned Lark. Abundant on the prairies.

73. Pica pica hudsonica. American Magpie. Very common, breeds.

74. Cyanocitta stelleri annectens. Black-headed Jay. Common, breeds.

75. Perisoreus canadensis capitalis. Rocky Mountain Jay. Common.

76. Corvus corax sinuatus. American Raven. Not uncommon.

77. Corvus americanus. American Crow. Generally distributed.

78. Nucifraga columbiana. Clarke's Nutcracker. Common in the mountains.

79. Dolichonyx oryzivorus. Bobolink. Common in the fall on the reservation.

80. Molothrus ater. Cowbird. Not common.

81. Xanthocephalus xanthocephalus. Yellow-headed Blackbird. Seen only at Swan lake.

82. Agelaius phoeniceus. Red-winged Blackbird. Not very common.

83. Sturhella magna neglecta. Western Meadowlark. Abundant.

84. Spinus pinus. Pine Siskin. Abundant, breeds.

85. Scolecophagus cyanocephalus. Brewer's Blackbird. Abundant, breeds.

86. Coccothraustes vespertinus montanus. Western Evening Grosbeak. Very common in 1901 in the vicinity of the Station.

87. Carpodacus cassini. Cassin's Purple Finch. Common at the head of Swan lake.

88 Loxia curvirostra minor. American Crossbill. Generally common in late summer.

89. Spinus pinus. Pne Sisikin. Abundant, breeds.

90. Pooecetes gramineus confinish. Western Vesper Sparrow. Abundant, breeds.

91. Ammodramus savannarum perpallidus. Western Grasshopper Sparrow. Common.

92. Spizella socialis arizonae. Western Chipping Sparrow. Abundant, breeds.

93. Junco hyemalis shufeldti. Shufeldt's Junco. Common, breeds.

94. Melospiza melodia montana. Mountain Song Sparorw. Common, breeds.

95. Melospiza lincolnii. Lincoln's Sparrow. Not common.

96. Melospiza georgiana. Swamp Sparrow. One specimen taken Aug. 11, 1900, from a group of three or four.

97. Passerella iliaca schistacea. Slate-colored Sparrow. Found breeding in the woods at the base of McDougal Peak.

98. Pipilo maculatus arcticus. Arctic Towhee. Common, breeds.

99. Habia melanocephala. Black-headed Grosbeak. Common, breeds.

100. Cyanospiza amoena. Lazuli Bunting. Common, breeds.

101. Pirang ludoviciana. Louisiana Tanager. Abundant, breeds.

102. Petrochelidon lunifrons. Cliff Swallow. Common.

103. Hirunda erythrogastea. Barn Swallow. Common, breeds.

104. Tachycineta bicolor. Tree Swallow. Common, breeds.

105. Clivicola riparia. Bank Swallow. Common, breeds.

106. Ampelis cedrorum. Cedar Waxwing. Abundant, breeds.

107. Vireo olivaceus. Red-eyed Vireo. Common, breeds.

108. Vireo gilvus. Warbling Vireo. Common, breeds.

109. Dendroica aestiva. Yellow Warbler. Abundant, breeds.

110. Dendroica auduboni. Audubon's Warbler. Common, breeds.

111.Dendroica townsendi. Townsend's Warbler. Abundant, breeds.

112. Geothlypis macgillivrayis. Macgillivray's Warbler. Common, breeds.

113. Geothlypis trichas occidentalis. Western Yellow-throat. Common, breeds.

114. Icteria virens longicauda. Long-tailed Chat. Abundant at Selish, on reservation, and at Bigfork.

115. Sylvania pusilla. Wilson's Warbler. Found nesting at McDonald lake, June 24, 1901.

116. Setophaga ruticilla. American Redstart. Abundant, breeds.

117. Cinclus mexicanus. American Dipper. Common, breeds.

118. Galeoscoptes carolinensis. Catbird. Common, breeds.

119. Salpinctes absoletus. Rock Wren. Common.

120. Troglodytes aedon aztecus. Western House Wren. Common, breeds.

121. Troglodytes hiemalis pacificus. Western Winter Wren. Common.

122. Cistothorus palustris plesius. Western Marsh Wren. Noted only at the head of Swan lake, 1902.

123. Certhia familiaris montanus. Rocky Mountain Creeper. Common.

124. Sitta carolinensis aculeata. Slender-billed Nuthatch. Common.

125. Sitta canadensis. Red-breasted Nuthatch. Common.

126. Parus atricapillus septentrionalis. Long-tailed Chickadee. Common, breeds.

127. Parus gambeli. Mountain Chickadee. One specimen noted on McDougal Peak. Breeds at Bigfork.

128. Regulus satrapa. Golden-crowned Kinglet. Common.

129. Regulus calendula. Ruby-crowned Kinglet. Common, breeds.

130. Myadestes townsendii. Townsend's Solitaire. Common, breeds.

131. Hylocichla fuscescens salicicola. Willow Thrush. Not uncommon, breeds.

132. Hylocichla ustulatus swainsonii. Olive-backed Thrush. Abundant, breeds.

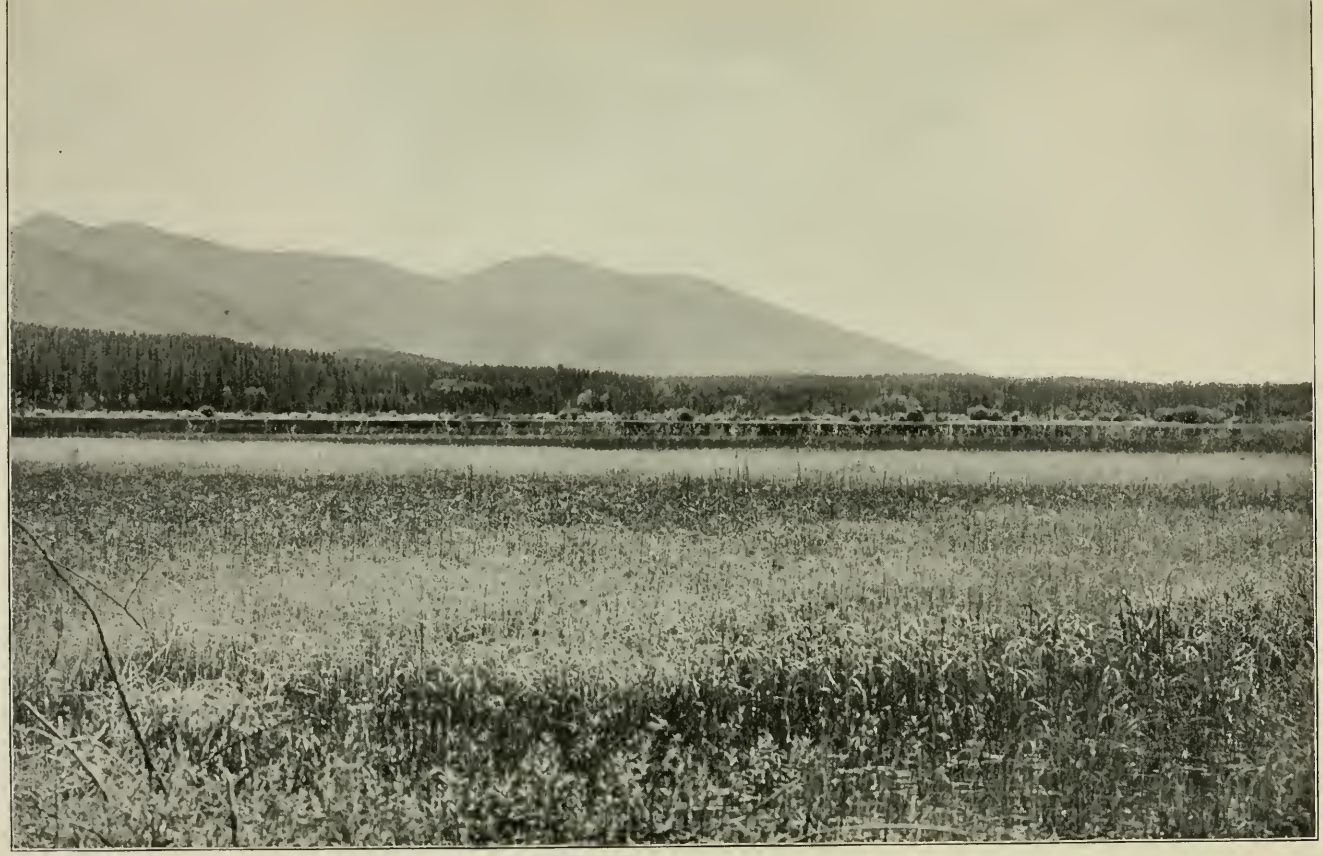
133. Merula migratoria propinqua. Western Robin. Abundant, breeds.

134. Ixoreus naevius. Varied Thrush. Common at the head of Swan lake, breeds.

135. Sialia arctica. Mountain Bluebird. Common.

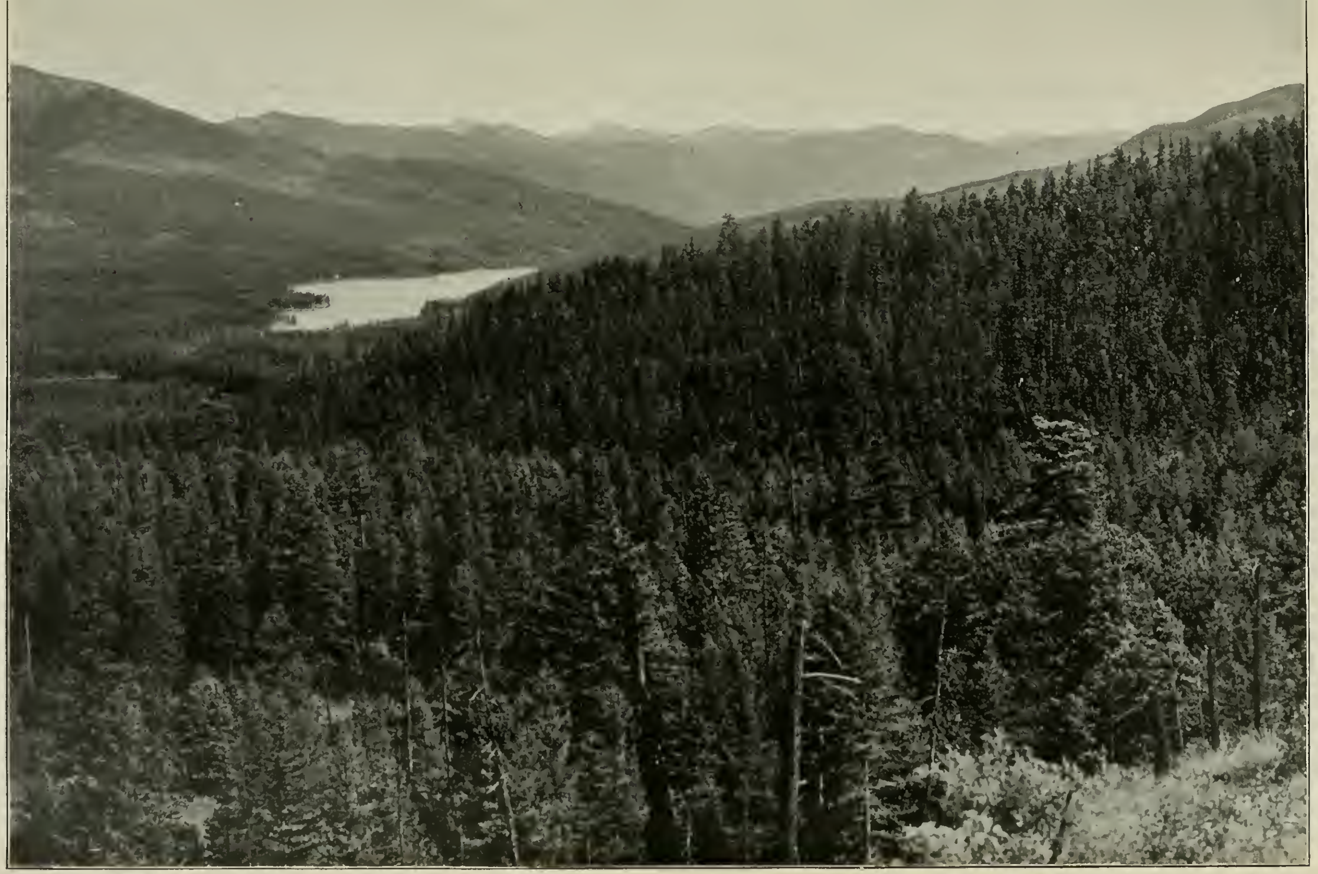
136. Recurvirostra americana. American Avocet. Only one specimen observed, Flathead river, 1903.

137. Seiurus noveboracensis notabilis. Grinnell's Water-Thrush. Common, in swampy woods. Breeds.



Swamp at upper end of Swan Lake. Note the vegetation surrounding a stretch of open water, behind which is a fringe of willows, alders and swamp birches. Compare with Plate LIII. Southern end of Swan Range in the background. Photo in July, 1902, by M. J. Elrod. The view is S. E.

Showing height and density of the vegetation in the swamp at the upper end of Swan Lake. Photo by Maurice Ricker.



View of lower end of Swan Lake, from low summit of Mission Range, near the Laboratory. Most of the lake is hidden by the mountain slope. Note the dense forest on all sides. The first snow mountain on the left is Hall Peak. Photo in July, 1902, by M. J.

View from summit of Hall's Peak, looking southeast, across the densely wooded valley above Swan Lake, toward Mission Range. The high snow-clad summit on the right is McDonald. Swan River meanders through the wooded valley. Photo by M. J. Elrod, July, 1902.

Bulletins of the University of Montana, Biological Series.

No. 1. Summer Birds of Flathead Lake, by P. M. Silloway. 84 pp., Plates I—XVI.

No. 2. Announcement of the Fourth Annual Session of the University of Montana Biological Station. 4 pp.

No. 3. A Biological Reconnoissance in the Vicinity of Flathead Lake, by Morton J. Elrod. Pp. 89—18-21, plates XVIII—XLVI, figs. 1—3.

No. 4. Anouncement of the Fifth Annual Session of the University of Montana Biological Station. Pp. 183—190, 4 ills.

No. 5. Lectures Delivered at the University of Montana Biological Station during the Session of 1902. Pp. 191—288, plates XLVII—LII, figs. 4—31.

No. 6. Additional Notes to Summer Birds of Flathead Lake, by Perley Milton Silloway, with Introduction by Morton J. Elrod. Pp. 289—308, plates LIII—LVII.

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